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MUNICIPAL ENGINEERING

VOLUME XXXIII. OCTOBER, NINETEEN HUNDRED SEVEN. NUMBER FOUR.

THE WATER PURIFICATION PLANT OF HARRISBURG, PA.

THE FILTERS AND THEIR OPERATION.

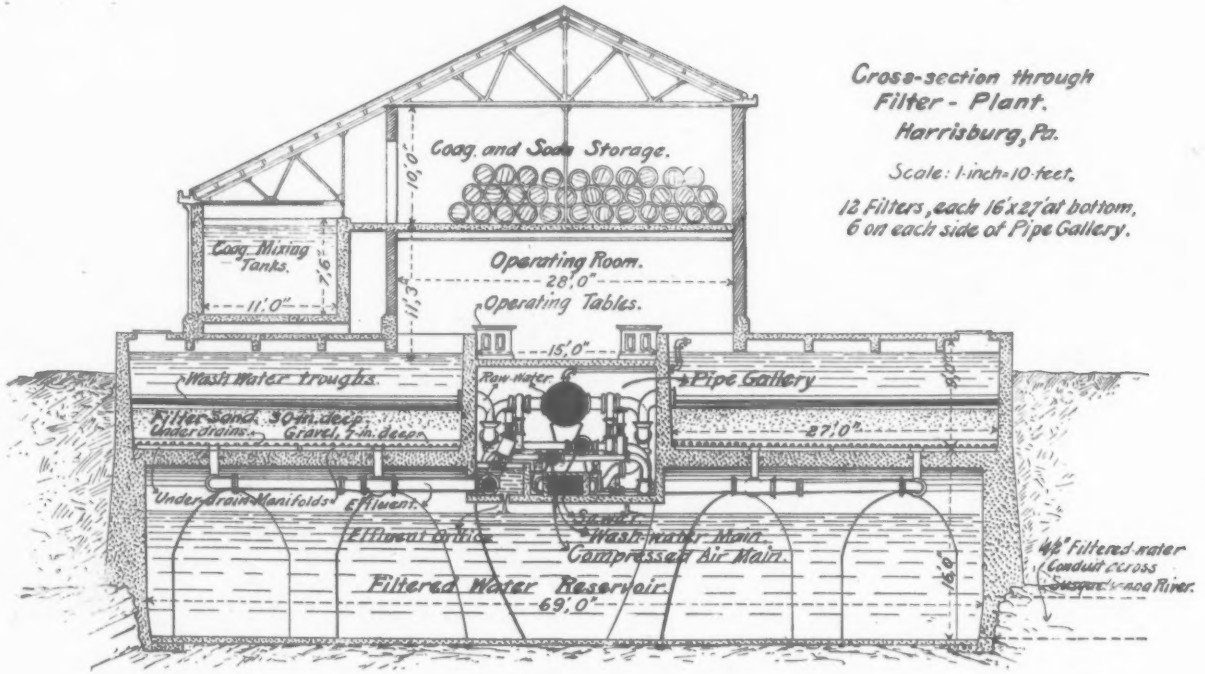
The description of the construction of the Harrisburg, Pa., plant for filtering Susquehanna River water, which was given in the September number of MUNICIPAL ENGINEERING is supplemented with this article describing the operation of the filters and the apparatus used.

Filters.—The filters, of which there are twelve, are arranged in two rows of six each, and are supported on concrete arches resting on transverse arched walls 3 feet thick carried by piers resting on the bottom of the reservoir 3 by 4 feet in section. The concrete in heavy mass work is mixed one part Portland cement, three parts sand, and six parts broken stone, and is not reinforced.

Each filter is a box of reinforced concrete 16 feet wide 27 feet long and 9 feet deep, built independently and as a monolith, and has an effective area, at the sand surface, of one one-hundredth of an acre. Before starting the concrete work on a filter the forms for the inner and outer surfaces and roof would be erected, the reinforcing steel be placed in position, securely fastened with wires, and all the castings and pipes passing through the concrete properly placed and securely held so as not to be displaced during the concreting. The concrete for the filters was mixed one part Portland cement, two parts sand, and four parts broken stone, and when once started, concreting was not allowed to be stopped until the entire filter was completed. Each filter was built in this manner, entirely independently of all others. At the outer end of each filter a circular manhole 30 inches in diameter was placed to permit placing or removing the sand. The roof of each filter covered it up completely to within 5 feet 6 inches of the inner face of the filter. This space was left open to give access to the filter from the operating floor and permit watching the operations of washing and the degree of coagulation of the applied water. Just back of the open spaces in the roofs a reinforced concrete beam extends the whole length of the plant on both sides and forms the foundation for the two-story brick building carried on the filters. The ends of two filters as they project into the operating room are shown in Plate II, and they also show in Plate IV.

Each filter is controlled by 6 valves located in the pipe gallery, Plate III; one to admit raw water upon the surface of the filter, one to control the rate of filtration, one to control the admission of wash water, one to control the admission of compressed air, one to control the escape of the dirty wash water and one to control a drain for emptying the filter. Each of these valves is provided with a hydraulic cylinder for opening and closing, operated by water pressure from the pressure main. The influent pipe is controlled by a 12-inch valve, the effluent by a 14-inch valve, the wash water admission by a 10-inch valve, the compressed air admission by a 6-inch valve, the wash water effluent by a 12-inch Coffin sluice gate and the drain by a 4-inch valve.

Pipe Gallery.—Between the two rows of filters, which stand 15 feet apart from face to face, and carried on concrete steel beams extending across the space from pier to pier, is the pipe gallery, in which are located all the pipes and valves connected with the filters. This gallery is water tight and when the plant is in operation the floor of the same is about three feet below the level of the water in the filtered water reservoir and subjected to an upward



I. HARRISBURG FILTER PLANT.

pressure equivalent to this height. Plate III shows part of the gallery and Plate I a cross section of it.

Each filter contains a system of pipes for the removal of the filtered water, and for distributing the wash water and compressed air during the operations of washing, a 7-inch bed of gravel of assorted sizes surrounding these pipes, a bed of specially prepared sand 30 inches deep, resting upon the layers of gravel, and two steel troughs reaching across the filter longitudinally to admit the unfiltered water upon the filter and remove the dirty water when the filter is being washed.

No special screens or strainer cups are used to prevent the sand from working down and passing out with the filtered water, and no specially constructed orifice boxes for the admission of compressed air during washing. The gravel underdrains consist of two layers of gravel, the first composed of stones passing a ¾-inch and remaining upon a ¼-inch screen; this layer is 4 inches thick. The top layer of gravel is 3 inches thick, and made up of gravel passing a ¼-inch mesh screen but remaining on one having 12 meshes to the inch, with not over 2 per cent. that will pass a sieve having 15 meshes to the inch. These sizes were determined practically for the particular gravel to be had locally; with different materials possibly other grading might prove more advantageous.

Sand.—The filter sand was, with the exception of a small amount, secured locally from the Susquehanna and Juniata sand bars, and was prepared in the filters by alternate washings and scrapings to remove the fine materials carried to the surface. The specifications called for sand not more than ¼ per cent. of which should be smaller than 0.24 mm.; not more than 10 per cent. smaller than 0.35 mm.; at least 90 per cent. finer than 0.80 mm.; practically all particles smaller than 1.00 mm.; and the uniformity coefficient from 1.3 to 1.4. The Susquehanna river sand was known from analyses to be satisfactory as to chemical composition and no restrictions were placed on it in this regard, although if an imported sand were used, the specifications stipulated the limiting amounts of lime, magnesia, iron, and alumina permissible. The sand as finally prepared, conformed to these specifications, the average effective size being about 0.38 mm., and the average uniformity coefficient 1.3.

Raw Water Main and Shutter Valve.—The raw 42-inch water main enters the pipe gallery from the south end and passes through the center on concrete piers 7.38 feet above the floor. Just after entering the pipe gallery a 42-inch shutter valve is located. This valve is operated by a hydraulic cylinder operated by a float resting on the water in a small concrete chamber connected by means of a pipe with the 42-inch main about midway of its length. The object of this valve is to automatically maintain the water on the filter at a constant depth. Vent pipes, 2 inches in diameter, discharging over the filters, afford relief from water hammer. Opposite each pair of filters 12-inch branches leave the raw water main, dividing into two lines leading to the two raw water inlet troughs to each filter. A third branch drops downward and connects with the central sewer on the floor of the pipe gallery. Plate I shows locations of all the above apparatus.

Control of Valves.—All the valves are manipulated from the operating room above the pipe gallery, shown in Plate IV. Each hydraulic cylinder has two small pipes leading, one from either end, to a four-way cock in a manifold underneath the operating table. These four connections are, one from the pressure main, one to each end of the hydraulic cylinder and one for a waste pipe. By turning the valve in the proper direction, therefore, water from the pressure-main passes to the corresponding end of the hydraulic cylinder, raising the piston and opening the valve, the water from the other end of the cylinder being forced out through the upper pipe to the four-way cock and thence to the drain. A reversal of the direction of opening the four-way cock closes the valve. The spindles of the four-way cocks are carried up through the operating tables. To the piston of each cylinder a wire leads over the pulleys to a grooved wheel lying horizontally below the top of the proper operating table, and just back of the handle for operating that particular valve, the axle of the grooved wheel being carried up through the top and carrying a pointer which shows the extent to which the valve is opened or closed.

Effluent Controller.—Each 14-inch effluent valve, in addition to being controller by hand, has an automatic regulator. Through this 14-inch valve the filtered water is discharged into a concrete box 3 feet 6 inches wide, five feet long, and 2 feet 6 inches deep, built on the floor of the pipe gallery close to the front of the filter. A cross-section of a box is shown in Plate I.

II. Individual Filters.

III. Pipe Gallery.

HARRISBURG FILTER PLANT.

In the bottom of the box is a bronze plate having an orifice 6 inches wide and 10 inches long, to the reservoir underneath. This plate is provided with a slide to allow of changing the size of the orifice at will. A pointer traveling along a scale on the operating table indicates the extent to which the orifice is opened and also the quantity of water in gallons per 24 hours passing through the orifice when the water in the box stands two feet deep over the orifice plate. By maintaining the water at this depth a constant rate of discharge is secured, and this rate can be changed to suit the necessities of the case by opening and closing the slide. The water is kept at a constant depth by means of a float resting on the water in the orifice box which partially closes or opens the 14-inch valve, and in a short time comes to rest at the proper place to maintain a constant level in the box. As the filter clogs up the 14-inch valve is gradually and slowly opened to correspond so that the rate of filtration is maintained at a uniform speed automatically.

At times when the filters are delivering more water than the pumps are taking away, the water in the filtered water reservoir will rise up and submerge the orifice plates thus reducing the head over the orifice and cutting down the discharge. If the Harrisburg pumps should be shut down, therefore, the filter plant would also automatically stop filtering water without accident or inconvenience. A differential gauge was designed to show automatically the percentage of the full-rated discharge for different depths of submergence. Thus, if the filter is set to deliver 1,000,000 gallons daily with a free discharge through the orifice but the orifice runs submerged, the actual discharge is obtained by multiplying the free discharge by the percentage shown on the disc. There is also placed on each operating stand a loss-of-head gauge indicating the amount of clogging in the filter while in operation, and arranged to ring a gong when the loss of head reaches about 9 feet, as it is then necessary to wash the filter and start it over afresh. Each filter has its own operating stand which is located in front of it on the operating floor.

The operating room containing these tables, Plate IV, is 28 feet wide, 106 feet long and the ceiling is 10 feet 9 inches above the floor. The operating floor is 15 feet wide, of reinforced concrete, carried by reinforced beams with openings at each operating stand provided with ladders for descending to the pipe gallery floor. There are three entrances to the room at the floor level.

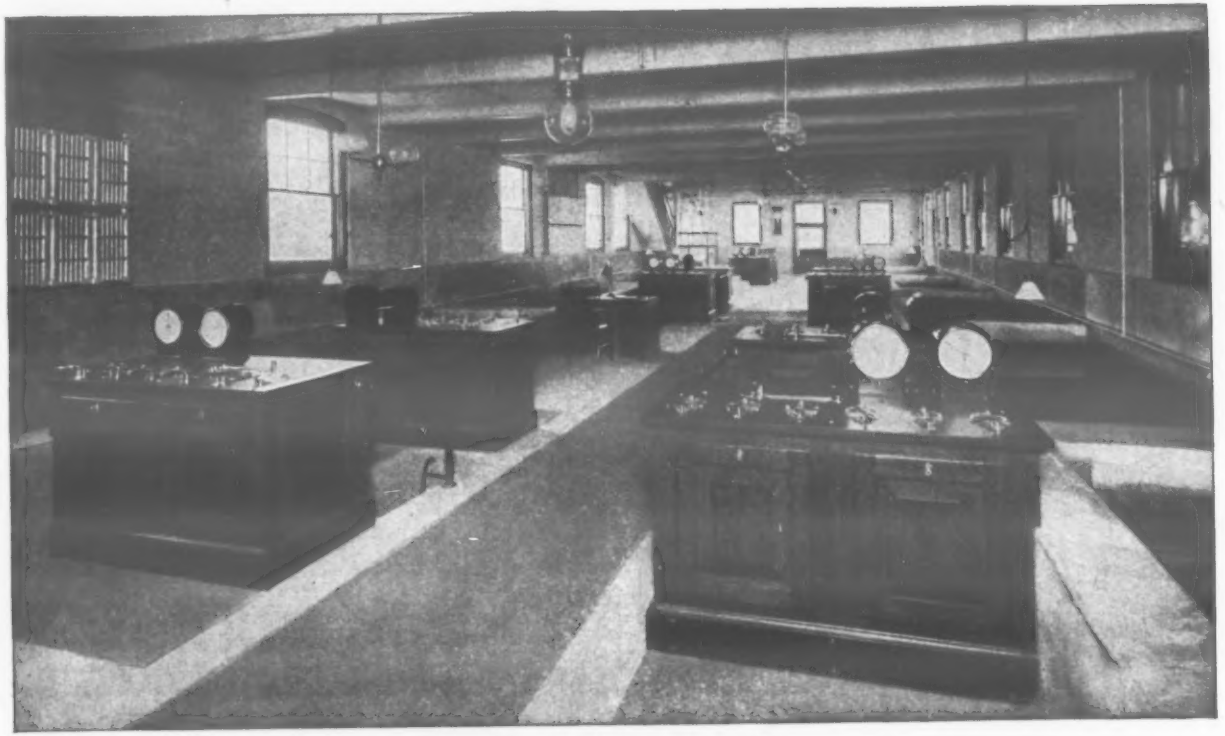
The coagulant storage room, Plate V, which is 28 by 53 feet, is over the north end of the operating room and is designed for a load of 750 pounds per square foot. There is storage space for about 200 tons of chemicals. In this room are scales for weighing out the chemicals, a coagulant hoist for raising the barrels to the room from the ground outside, and the coagulant regulating orifice boxes.

The tanks for mixing the chemical solutions, Plate VI, are located to the west of the operating room and rest on the tops of the three north filters of the west row. There are four of these tanks, two are 11 feet wide, 16 feet 9 inches long, and 7 feet 6 inches deep, inside, for mixing the coagulant solution, and two, 11 feet wide, 8 inches long, and 7 feet 6 inches deep, for mixing the soda ash solution. These tanks are of reinforced concrete.

Each coagulant tank contains, in one corner, at the top, a cage with a copper wire bottom, supported on reinforced concrete beams, in which the crystals of aluminum sulphate are placed after weighing. The crystals are dissolved by a spray of water from a perforated pipe. By the time the tanks are filled the chemicals are dissolved. To maintain the solution of uniform density they are kept in agitation by compressed air forced in through a system of perforated copper pipes at the bottom of the tanks, the air being supplied by the Marsh air-compressors in the engine room. The arrangement for the soda mixing tanks is similar except that the air pipes are of galvanized iron instead of copper.

From these mixing tanks the solutions go by gravity through copper pipes to the coagulant pumps, and through galvanized iron pipes to the soda pumps in the engine room, which force the solutions up to one or several of the six orifice boxes in the coagulant storage room, Plate VII.

The orifice boxes measure and regulate the dosing required by the water under different conditions. Two of the orifice boxes are for soda and four for coagulant solution. Two of the coagulant and one of the soda boxes are designed for hand regulation and two coagulant and one soda for automatic control. The boxes are arranged in a nest and are each two feet wide, three feet long and 27 inches deep over



IV. HARRISBURG FILTER PLANT.
Operating Room.

the orifice plates. They are placed above three other boxes 15 inches wide, 4 feet 6 inches long and 20 inches deep, from which the solutions are conducted to the points of application.

In the bottom of each orifice box is a rectangular slot over an opening through the bottom of the box. In this rectangular slot, which is 3½ inches long and ½ inch wide for the coagulant and ¼ inch wide for the soda solution boxes, fits a slide to change the size of the orifice. The amount the orifice is to be opened is determined by the strength of the solution used, by the quantity of water being filtered, by the depth at which the solution stands over the orifice box and by the amount of chemical required per gallon of water filtered. When the filters are running with free discharge from the effluent orifice boxes the solution is maintained at a depth of two feet in the solution orifice boxes by float-and-lever valves placed on the discharge pipes from the solution pumps. A connection between these discharge pipes and the Foster pump-governing valves automatically regulates the pumps, by throttling the steam supply, to a speed sufficient to furnish the required quantity of solution without excessive pressure at the pumps, or against the float-valves. Two of the coagulant and one of the soda solution boxes are arranged thus, the quantity of solution used being regulated by hand. The three other boxes have an automatic apparatus whereby the quantity supplied will be governed by the quantity of water filtered. This regulation is accomplished by reducing the depth of water over the orifices in the solution boxes in the same amount that the filter effluent orifices are submerged. The device for this regulation consists of a large float in the filtered water reservoir so that it travels vertically down the water when it rises above the level of the filter effluent orifice plates. To this float phosphor bronze wires are attached, and carried up to the top of the three solution boxes, where they are attached to three bronze carriages traveling vertically on guides. On each carriage is fastened a float and lever valve, and connection is made between the valve and the solution pump discharge pipes at the tops of the tanks by means of soft rubber tubing. When the water in the filtered water reservoir rises above the filter effluent orifices, therefore, the large float rises and the carriages carrying the float and lever valves, in the three solution boxes, are lowered an equal amount, decreasing the depth of water over the solution orifices correspondingly and hence reducing the quantity of solution pouring through the orifices to correspond with the reduction in quantity of water being filtered.

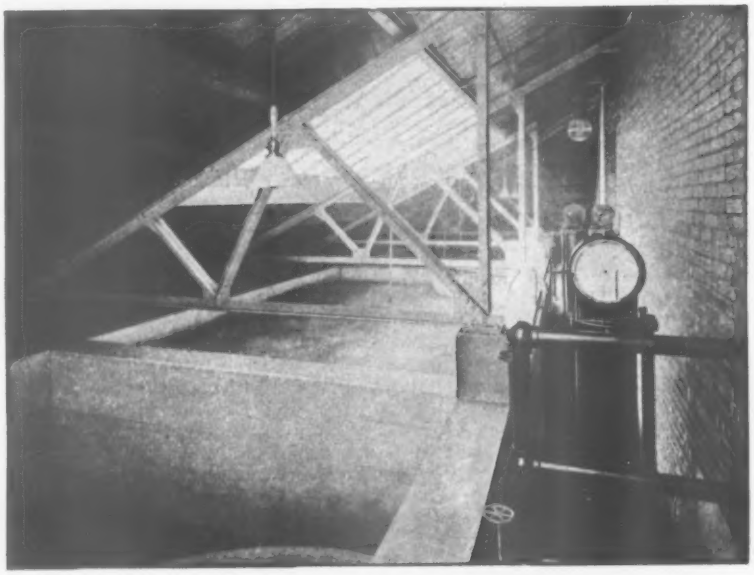
On the face of each orifice box is placed a glass tube gauge which shows the depth of solution over the orifices. There are, in addition, three self-recording depth gauges, one for each pair of coagulant solution, and one for the two soda solution boxes, operated by floats in standpipes connected with the bottoms of the boxes. In actual use they have shown their utility and justified their existence. If anything goes irregularly with the filters the gauge records tell the tale and give the time the trouble occurred, thus making it possible to place the blame.

The solutions fall from the orifices into the boxes below, from which the pipes conveying the coagulant to the raw water lead to the different points of application. The pipes in connection with the coagulant solution are of copper, iron pipe sizes, with acid bronze valves and specials. The pipes for conveying the soda solution are of galvanized iron with bronze valves. The soda solution is introduced into the raw water before the water passes through the low-lift pumps. A manifold of perforated pipes is placed in the intake well and hung on a swivel joint on a horizontal axis at the top to permit ice and other floating matters to pass without forming a dam behind the manifold. The soda solution pipe connects with the manifold through this axis.

The coagulant solution can be admitted at two points. One connection is in the 30-inch force main between the pump and the sedimentation basin; the other is in the 48-inch reinforced concrete pipe at the south end of the sedimentation basin just before the water enters the secondary coagulating basins. Both connections are through manifolds of perforated copper pipes. The manifold in the 30-inch pipe is in two halves hung on horizontal axes, the manifolds standing at an angle of 45 degrees with the horizontal against the direction of the current, so as not to form obstructions to cause the arrest of such matters as might go through the pipe with the raw water.

In the operation of the plant, the coagulant, when the water is in good

V. Coagulant Storage Room.



VI. Solution Tanks.
HARRISBURG FILTER PLANT.

condition, is admitted only at the entrance to the secondary coagulating basins; when bad it is admitted through both connections.

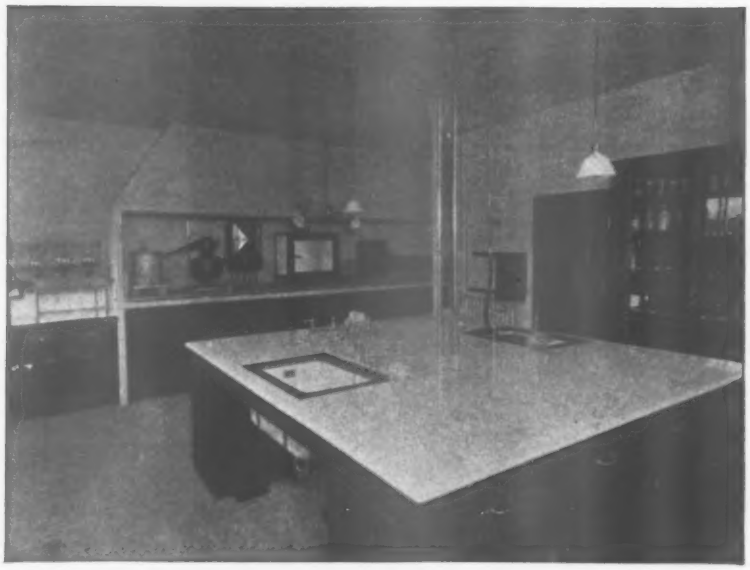
Office and Laboratory.—Adjoining, and just south of the coagulant storage room is the office of the superintendent, 15 feet by 19 feet 10 inches, next to which is the storage room 11 feet by 19 feet 10 inches. The southern end of this floor is occupied by the chemical and bacteriological laboratory. The apparatus is that which was purchased for use in the laboratory of the experiment station.

The laboratory has three rooms, a large chemical laboratory, 17 feet 10 inches by 26 feet 3 inches, Plate VIII; plating room 10 feet by 11 feet, Plate IX; and a counting room 10 feet by 9 feet. In the chemical laboratory is the hood containing the steam bath, stills, sterilizers, gas stoves, etc., at one end of which is the autoclave. The ammonia stills are on a table at the other end of the hood.

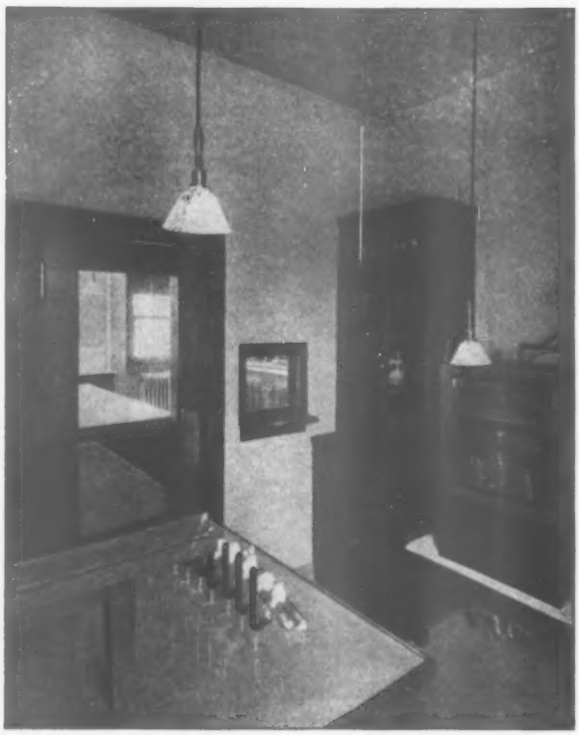
Tiled-top tables, the shelf for the turbidity standards, in front of an 8-foot window glazed with a single sheet of French plate glass, porcelain sinks and connections for gas, filtered water and steam are provided.

In the plating room are placed the 20 degree and the 37½ degree incubators, the cooling plate, a sink, and table. The ice-box is arranged so that ice is put into it from the hall. In the ice-chamber of the refrigerator a manifold is placed through which filtered water circulates for regulating the temperature of the 20 degree incubator, and for supplying the cooling plate. The automatic regulation of the 20 degree incubator is accomplished by means of a thermostat electrically connected to a clockwork movement in such a way that if the thermostat makes a connection with one binding post the clockwork is released and opens the valve of the cold water pipe, permitting the water to circulate through the outer jacket of the incubator until the temperature inside the inner chamber falls sufficiently to cause the bar of the thermostat to make a connection with the other binding post, which again releases the clockwork and closes the valve. This apparatus, when properly adjusted, will maintain the temperature of the inner chamber practically constant, the variation being not over half a degree either way from the desired figure.

VII. HARRISBURG FILTER PLANT.
Coagulant Orifice Boxes.



VIII. Chemical Laboratory.



IX. Plating and Incubator Room.
HARRISBURG FILTER PLANT.

The thirty-seven and one-half degree incubator is regulated by a mercury tube which controls the supply of gas to the flames supplying heat, in the usual way.

The counting room contains a white glass-topped working table, the balance on a masonry foundation, a porcelain sink, and a case with sliding doors for the microscopical and other apparatus needed in this room. Each room is provided with shelves, cases having sliding glass doors, for chemicals, glassware, apparatus, etc.

The entire plant is heated with steam, lighted with gas and electricity and provided with all the necessary sanitary appliances of the best quality.

SOME RELATIONS OF STREAM POLLUTION AND WATER PURIFICATION.

By Charles Carroll Brown, M. Am. Soc. C. E., Consulting Engineer, Indianapolis, Ind.

The discussion of stream pollution which was printed in the September number of MUNICIPAL ENGINEERING in an article under the above heading, was followed in the lecture from which these extracts are taken by the following consideration of water supplies and their purity.

Some discussion of the sources of water supplies and the purification of water is now in place.

As already stated, the larger cities are obliged to resort to surface water, mainly because underground sources are insufficient or inordinately expensive. The history of the Indianapolis water works is typical, most cities passing through several if not all of the stages which will be described.

When the works were established about 1870, water was pumped from White river at the foot of the main street on the west side of the city and near the middle, measuring north and south. For a few years this supply was reasonably satisfactory, but was never wholly so. As the city grew toward the north and the streams flowing to the river above the waterworks became more polluted, and industrial sources of pollution became more serious, the main pumping station was established just above the largest of these tributary streams, out of reach for some years of the city's own pollution. Here a connection was made with the river by a submerged gallery, supposed to strain the water, and a filter gallery, so-called, was made in the gravel, parallel to the creek, from which water was pumped. Although the gravel bed was so porous that roily water was often present in the gallery at flood times, the voids in it were filled with the fine material in the water and this, with the increase in demand from the city, caused extensions of the gallery, both open and in tunnel, in efforts to make the supply keep up with the demand. Direct draft from the river was resorted to on occasion to supply deficiencies at times of heavy draft for fires, or when the ground water was low and the demand was great, as in the summer season and in the dead of winter. Increasing pollution in the river from the growth of the city itself, from other cities above, from more thickly settled farming districts, and from large and numerous manufacturing establishments caused the board of health to condemn this direct connection with the river, and to look with some suspicion on the gallery supply.

In its search for water the water company drove some wells in the bed of the gallery and found flowing artesian water which served to increase the gallery supply, but an increase in the number of wells reduced the head of the flowing water, and they ultimately failed entirely. The company had purchased a large tract of ground about the pumping station and proceeded to locate deep wells, say 200 to 300 feet in depth, and put them in operation. In these deep wells the water rose near the surface, but when pumped the surface of water in the well dropped a distance which has gradually increased until at the time the wells were kept in full operation it was, I understand, some seventy f[illegible]

below the surface. It would evidently be impossible to pump these wells by suction from the main pump, and the alternatives were small pumps, one over each well, or the air lift. The latter was selected. The water is very hard, and much of this hardness is due to iron salts. The aeration by the air lift caused much of this iron to settled in the basin to which it flowed from the wells, and thus obviated the necessity of softening treatment. The wells became an expensive luxury to the company, because the air lift is not an economical method of lifting water on so large and constant scale, because the lift was becoming greater each year, and because the wells became clogged in the course of time, so that it was necessary to put down frequent new wells to replace those worn out, and to meet the additions to the demand. The company finally decided, partly on account of the expense and partly because the city health authorities were complaining of the quality of the water, claiming that river water must be used to eke out the increasing deficiency in the well water supply, to put in a filter plant sufficient to filter all the water used by the city. The water is taken from the river well above the city by a canal some six or eight miles long, and is filtered by the slow sand filtration process. Until enough filter beds are completed to supply all the demand the wells are drawn upon.—This case is an example of most of the points which I desire to make in this paper.

First. The original plant was located where it was soon subject to pollution from the city itself. Naturally, if the plant belongs to the city, the cost of the new plant made necessary by this condition should be paid by the city. Under private ownership it was paid by the company.

Second. The pollution in the stream from what may be termed general sources increased until it approached the limit, and comparatively small additions of concentrated pollution from city sewers and the waterborne refuse from manufacturing establishments carried it over the limit. This general pollution is due to the action of the stream as a drain for its watershed. It would require a certain amount of purification of the water to render it absolutely safe for domestic use, though, without city sewage and factory refuse, it would not ordinarily be considered dangerous. It places on the water plant, however, the practical necessity of some expenditure of money in constructing and operating some kind of a filter plant. The general action of the stream as a drain for its district is ordinarily considered a natural one, and there has been no serious question of the duty of the water plant to pay for such purification as it may need. The company has, however, by suits, enjoined such industrial pollution as straw board waste, some of the effects of which cannot be removed by filtration.

In the State of New York the State Board of Health is given power to make rules for the protection of the watersheds of streams used as water supplies, which rules have been applied, mainly, if not entirely, to streams appropriated wholly for water supplies. These rules place upon property on the watershed a burden of expense which adjoining property outside the watershed is not required to bear, but, thus far, it has been jusfied as a sanitary measure.

Similar regulations are enforced on the watershed of the Boston water supply, and the general health laws of New Jersey, Ohio and Minnesota give the State Board of Health power to prevent similar pollution, without prescribing so fully the method of doing so. Up to the present time, western states have not developed the state of mind which the more thickly populated states have reached, which makes them willing to submit to such sanitary restrictions as those named, and it is probable that no State Legislature west of New York would at this time pass a law like that authorizing the rules referred to. They may come to it some time, but the time is not yet. It may then be assumed that the pollution from the ordinary general action of the stream as a drain for the country through which it runs must be removed at its own expense by the city or company desiring to use it for water supply. Sanitarians are now practically unanimous in their opinion that all surface water supplies should be filtered, the amount of filtration depending on the character and amount of the pollution.

Third. The sewers of cities and towns are the drains of the portion of the watershed which they serve. This drainage is capable of producing a nuisance if the stream into which it discharges is small. It seriously affects the safety of the stream as a source of water supply for some dis-

tance, depending on conditions, some of which have been described. If this sewer system is a new one, it is probable that purification could be required by law, if there is a water supply below which would be affected. If it is an old one, put in before the water supply was taken from the river, the case is somewhat different. Prescriptive rights—first in the field—might have some effect on the decision as to whether the water supply should be purified at the expense of its owners, or the sewage should be purified at the expense of its city. Thus far the cases settled have been on the basis of purification of sewage by the city producing it, although the Passaic river water supply of Jersey City was condemned and ordered out rather than to attempt to purify the river by purifying the sewage discharged into it. There is the probability of nuisance in all but the largest rivers, which fixes the cost of purification on the city producing it, so that the large cities will doubtless have the burden of purification of their sewage to carry. It is very doubtful, however, whether a general order to all cities to purify their sewage could be enforced, except where there was definite evidence of permanent and serious injury to interests below, or to the health of communities below, through their water supplies or through the nuisances produced. The problem is one of increasing importance, and states are gradually falling into line and passing laws upon the subject, These laws are usually inefficient, because they are passed without a thorough study of the whole question, and so cover only some special phase of it, which has caused trouble to some one with force enough to get a law passed to attempt to regulate it.

QUALITIES AND METHODS OF USING CEMENT.

By S. B. Newberry, Sandusky, O.

Some good practical information regarding qualites of varous cements and methods of use were presented in a paper before the Ohio Builders' Supply Association from which the following is abstracted:

There are really three different kinds of hydraulic cement in use: Puzzolan or slag cement, Natural cement, Portland cement.

A few words on the differences between these may be of interest. You know that the Romans made very good cement, and many of their concrete structures have lasted till the present day. Their cement was simply a mixture of a volcanic scoria, called "pozzuolana," with slaked lime. This, and some other materials such as some kinds of blast furnace slag, have the property of making lime hydraulic; that is, causing it to harden under water. Slag cements, consisting of slag ground with slaked lime, are made today by the iron companies in considerable amount. They make good mortar, and are useful in concrete kept constantly wet, but are much inferior to Portland cement in strength and hardness.

In 1756, when the Eddystone lighthouse, off the coast of England, was built, Smeaton, the engineer in charge, made experiments to find the best of lime to mix with Roman pozzuolana for use in the work. He found that certain limes hardened better under water than others, and on dissolving in acid found in these limes left a considerable residue of insoluble clay.

This was the first discovery that the combination of clay and lime gives hydraulic properties. Smeaton wrote: "I do not doubt to be able to produce a cement equal to the best Portland stone." From this remark the name "Portland cement" is derived.

Soon after Smeaton's experiments, limestones containing a high proportion of clay were found in France and England, and the manufacture of "Roman cement" was begun. It was found that if the stone contained perhaps 25 per cent. or more of clay, and was burned at low heat, the burned lumps would not slake with water, but if ground to powder a quick setting, natural cement resulted, which hardened very well, and this product soon became extensively used. In this country the manufacture of natural cement, such as the Milwaukee, Louisville and Rosendale, has become an important industry, though it has diminished with the growth of Portland cement manufacture.

If this natural cement rock is burned at a high or white heat, it melts to

a slag which has no cement properties. If, however, we take a limestone containing less clay, generally about 20 per cent., and burn at white heat and grind the clinker to powder, we obtain a slow-setting cement of much greater hardness than the natural product. This is Portland cement. If we could find beds of limestone containing just the right percentage of clay, and perfectly uniform in composition, we could then make Portland cement simply by burning and grinding. But as a variation of ½ per cent. in the amount of clay, either way, is enough to injure or ruin the quality of the product, it will readily be understood why suitable deposits have practically never been found.

On the other hand, it is possible to mix carbonate of lime (limestone, marl or chalk) with just the right amount of clay, and thus prepare an artificial mixture which will stand burning at white heat and yield Portland cement of the highest grade. This was first done by Aspdin, in England, in 1827, and the industry rapidly extended in England and Germany. Portland cement was first made in this country about 1878. At the time our mill, near Sandusky, was built, in 1892, the amount of Portland cement made in the United States was less than half a million barrels. This year it will be over fifty million barrels. This is, in fact, the cement age. Mr. Ross F. Tucker, a prominent concrete engineer of New York, in speaking before the Association of Cement Manufacturers at Atlantic City last year, said: "You have seen your product increase in fifteen years from practically nothing to 45,000,000 barrels, and you cannot now supply the demand. Engineers have only been experimenting with Portland cement thus far, and have found it suitable for their work, and you may be assured that within ten years you will have to furnish at least ten times the amount of cement you are now making." I need not tell you that these remarks put us all into a very cheerful frame of mind. The past year has shown that Mr. Tucker's prophecy is quite likely to be fulfilled, and we can all see how, with the new uses which are being found for cement every day, five or ten barrels might easily be used for every barrel that is used today.

The materials for Portland cement are carbonate of lime and clay. The carbonate of lime may be chalk, as it is in England, or limestone, or limestone containing clay which we call cement rock, rock, or marl.

In some sections of this country, particularly in Indiana and Michigan, fresh water marl deposits are found, in the form of white paste. This is an exceedingly good cement material. Where cement rock or limestone is used, the materials are ground dry. Kilns are getting bigger and bigger each year. Those we are installing in our factories are 8 by 100 feet, and some of the factories in the east have kilns 140 and 150 feet long. A rotary kiln is a cylinder of steel lined with fire brick. It is slightly inclined and revolves at the rate of one revolution per minute. At the lower end coal in powdered form is blown in and burns just like a gas flame. The raw material is put into the upper end of the kiln and slowly comes down, gets red hot, gives off carbonic acid, the lime and clay become combined, and finally becomes white-hot when the carbonic acid is all given off, and passes out in white-hot pieces about the size of small gravel. This clinker from from the rotary kiln, consists of black, rounded grains. It merely has to be ground to powder—with addition of 1 to 2 per cent. gypsum to prevent quick setting—to produce finished Portland cement. I should now like to say a few words on concrete block construction. The progress is slow, because there are difficulties and prejudices to be overcome, but if one-half the buildings that are now made of wood were to be replaced by Portland cement, it would take a quantity of cement equal to all that is made today. Wood is disappearing and is not a good material for building. A good concrete block house costs no more than frame.

You can take drawings for a frame house and reproduce it in concrete blocks, and instead of having a perishable inflammable, hot, uncomfortable house, you will have one durable, cool in summer, warm in winter, and beautiful, at no greater cost. Well, if this is true—and we have demonstrated it—it seems that nothing can stop the very rapid replacement of wood by concrete. There is one great difficulty, and that has been the penetration of dampness. If we would make our concrete blocks of cement and limestone screenings, 1 to 2, they would be fairly watertight, but would be very expensive, and ten times as strong as they

need be. If we should make them 1 to 5, the mixture would be abundantly strong, but they would leak like a sieve and absorb water like a sponge. Something is needed to entirely repel water. We believe we have found this in our Medusa waterproof compound. We were astonished at the results obtained at our Bay Bridge bag house, which was built two years ago when we were merely making the compound on a small scale in our laboratory, of cement and limestone, 1 to 5, with the addition of compound to the amount of 1½ per cent of cement used. The building is absolutely dry, has never been plastered, and no trace of dampness has shown itself, and, though the bags are stored against the block wall, they are never damp in the least. Fifteen minutes after a rain the walls are dry, while those of the boiler house adjoining it, made without compound, are dark and damp for some hours. You can pour water on the boiler house walls about six feet from the ground and none of it will reach the ground, all being absorbed by the blocks, while if the same is done to the bag house every bit will run to the ground.

We have demonstrated its permanence by tests extending over two years, and in multitudes of cases it has been used under heavy water pressure. The cost of this waterproofing is very little; 1 or 2 cents is the cost of waterproofing a 32-inch block. We are interested in the concrete block manufacture at Cleveland. We use 1 per cent. of waterproof compound throughout the blocks, and guarantee them to be absolutely watertight. We guarantee buildings built of them to be dry and never have complaints. Before we used waterproof compound we had many complaints of dampness.

The constituents of Portland cement are four: lime, from limestone or marl, and silica, iron oxide and alumina, from the clay. With these four materials we can make Portland cement by combining the right proportions and burning and grinding. But some interesting things have been found as to leaving out one of these constituents. If we leave out the iron and have only silica, alumina and lime, we get a snow-white Portland cement. We looked over this country to find a deposit free from iron, and experimented on the process of making white Portland cement. This is quite a difficult operation, as the process is different and a very much higher temperature is required. We were successful in finding in Southeastern Pennsylvania a deposit of chemically pure limestone and deposits of white clay. We have a factory finished now and ready to start up in a week or two at York, Pa., where we are going to make this. It is guaranteed equal to gray Portland in all respects, but is free from iron. We expect that it will find extensive use in ornamental artificial stonework of every kind. Now, you can leave out the alumina and use only iron oxide, and Krupp of the steel works at Essen, Germany, and Dr. Michaelis of Berlin have patented in Europe and the United States a cement which contains no alumina, and in which the alumina is replaced by iron oxide. It resists the action of sea water. This injurious action of the sea water does not make any difference to us in Ohio, and the corrosion by sea water does not alarm us to any great extent. But on the sea coast that corrosion of sea water is a serious problem. It is caused by the action of the sulphates that the sea water contains on the alumina, and Portland cement free from alumina and containing iron oxide in place of it is absolutely unaffected by sea water. A specimen of this iron cement was, to make it more striking, immersed in sea water of five times it natural strength, and a specimen of Medusa cement was exposed in the same way. Both bars were the same length when put in the sea water. The ordinary Portland has increased three-eights of an inch in length, while the iron cement, free from alumina, is just as smooth and bright as when first made. This cement is not manufactured in the United States as yet, but there are parties in the east who propose to make this cement for sea water construction.

I do not want to leave this subject without saying a little more about concrete blocks and the way they should be made. You are all interested in that, as concrete block makers are good customers of yours and their demand forms a good part of your trade. The secret of making a good concrete block, and something which it seems almost impossible to get people to realize, is to get the material wet enough so that the material will be plastic. All blockmakers seem to have the notion that to make blocks dry and sprinkle them with water afterwards will produce good results. This is an error, for the use of the water is in

causing the mass to settle together into a dense, solid form. Blocks made too dry will always be soft and crumbling, and no amount of subsequent sprinkling will help matters. As much water must be used as possible without causing the blocks to stick to the molds or sag out of shape.

GARBAGE DISPOSAL AND STREET CLEANING.

By Alexander Potter, Consulting Engineer, New York City.

Before a convention of the League of Cities of the Third Class in Pennsylvania, held at McKeesport, September 11 and 12, Mr. Alexander Potter delivered an address upon "Municipal Sanitation," in which he considered in a general way the subjects of water supply, sewerage and water and sewage purification. He closed his address with the short discussion of the subjects of garbage disposal and street cleaning which is herewith reproduced.

One phase of municipal sanitation is the question of the disposal of the town's refuse. The science of garbage disposal is so well developed in this country, that no matter what the character of the waste may be it can be successfully dealt with. Some destructors are built to handle mixed and unsorted waste, while others are designed to take care of waste of a special kind. This is made possible on account of the practice in many cities of an assortment of waste products. Examples of both systems are in successful operation and have proved that the municipal waste can be destroyed without noxious results.

Many experiments and attempts have been made to turn the garbage, waste and refuse of cities to commercial value. This has been successful to a very limited degree. In American cities and under American conditions the separation of the garbage has been found of little commercial value, and the attempt to utilize the power represented by the calorific value of the waste, except to utilize it for the destruction of the waste itself and the production of a clinker or ash which is free from organic matter, is unwise.

Waste has been utilized for securing power by the generation of steam, but such cases are rare. You are all familiar, perhaps, with the plant erected in New York a few years ago to destroy the wastes (not the wet garbage) of a certain district of New York. The plan was to generate power to light the new Williamsburg bridge. They lit the bridge, the number of lights on the bridge being almost as many as it takes to light the city of McKeesport, but it was found that the expense of lighting by this method, was twice as great as a lighting company had offered to perform the same service for.

Again, owing to the great difference in the composition of the waste from hour to hour, the brilliancy of the lights were never uniform.

The character of the waste of each city presents an independent problem and one intimately connected with town sanitation. It is one of the most important problems with which a municipality has to deal and is strictly within the province of the sanitary engineer, whose advice should be sought. A certain arrangement or destructor in one city may give excellent results, but the same arrangement may fail when applied to waste of a different character in another city. There should, therefore, be a careful study of the subject before money is expended.

There are a number of good destructors on the market; so many, in fact, that a city is hardly warranted in employing an engineer to design one after his own particular but untested ideas. On the other hand, a city is not warranted in selecting a certain type of destructor without the advice of a competent engineer as to the adaptability of a particular type of destructor to handle the wastes of the particular character actually produced in any particular city.

One other important point. The operation of the destructor, when constructed, should not be assumed by the city under any circumstances, until the manufacturer has operated it successfully for one year. The cost of the destructor should include this service for one year. It is not sufficient that the plant be run under the direction of the builder, for there are too many ways for him to avoid the responsibility where the city has any hand whatsoever in the operation during that year, such, for instance, as his complaint that the city did not furnish sufficient help or help of a proper character. Consequently such

a guarantee is useless. The builder should agree to carry on its entire operation for one year. If a plant will run successfully for one year under the control of the builder, it should run successfully ever afterwards, provided replacements and extensions are promptly made as they are required.

Street cleaning is becoming an important division in the sanitary work of the city, but I will have time only to touch upon one constantly growing but nevertheless pernicious, practice which, while apparently advantageous at the present moment, will become the source of much injury and expense if long continued. I refer to the practice in many cities of washing down paved streets with hydrant water and fire hose, as well as from water tanks under pressure. This method is objectionable because it merely transfers the filth on the streets to the sewers. In cities where a sewage disposal system is in operation, its results would be apparent at once in the increased cost of operating the disposal system, even if not injuring it by overcrowding the beds and other parts of the disposal plant so that permanent damage is done.

I have watched such street washing and have seen tin cans, boxes, stones, straw bottle covers, and all kinds and shapes of articles swept down into the sewers, few of which objects would reach the outlet, but would lodge rather in the catch-basin or sewer. It is cheaper to remove dirt from the streets than it is to remove it from the sewers or catch basins. It is moreover a pleasanter and more agreeable job.

The use of water under pressure is deleterious to the pavements, reducing their life by many years. The use of water for such purposes also hastens the day when a new water supply must be secured, for it not only consumes vast quantities of water, but it also creates a wasteful sentiment in the minds of the people.

The use of water for street cleaning as opposed to street sprinkling should be discountenanced by all intelligent men. It is ludicrous to think of expending vast sums of money in filtering and softening water only to put it to such a use. The results of the use of water for flushing down streets are:

Ruined pavements.
Wasted water.
Plugged up sewers and catch basins.
Greater cost of maintenance.

The only redeeming feature of a street washing system is that it affords a more dignified and important position to the cleaning gang.

The thoroughly practical operation of machine sweeping has been fully demonstrated.

Some of the latter machines are operated successfully without creating a cyclone of dust and dirt.

The experience of cities where observations have been made on the cost of machine and hand sweeping, shows that the former can be accomplished at about a fourth the cost of the latter.

THE STEAMING OF TIMBER.

By Octave Chanute, Chicago, Ill.

The desirability of steaming of timber before preservative treatment has been doubted so much recently that the following paper before the National Association of Wood Preservers by the veteran in that work, Mr. Octave Chanute, of Chicago, will be of great interest, and as his authority on the subject is unquestioned, his words will have great weight.

Having been asked to prepare a paper upon the "Steaming of Timber," I think it is well to begin with a glance at the evolution of that process.

The original method of applying antiseptics for the preservation of wood was by soaking it in solutions, chiefly those of mineral salts, and that was the way in which ship timber for the "Wooden Walls of England" was treated, with fair results, over a century ago. With the opening of the railway era, more expeditious methods were called for, and in 1831, Breant, a Frenchman, was the first to force antiseptics into wood with hydraulic pressure. He used a closed, vertical cylinder in which the wood was placed upright on end and pressure applied with a pump. He indicated, moreover, that better penetration might be obtained by producing a partial vacuum in the cylinder before the admission of the antisep-

tics. Those which he employed were sulphate of iron, linseed oil and a mixture of linseed oil and resin.

Burnett patented the injection of chloride of zinc in 1838; he first employed the soaking method, but subsequently he used pressure in closed cylinders. Bethel, in the same year, patented the use of creosote, and used the Breant method, but his cylinder was horizontal, and he produced a partial vacuum therein before admitting the creosote. His apparatus and his methods were substantially the modern ones, and have continued in use to this day, but some difficulties were found in operating upon any but thoroughly seasoned timber, and in 1846 Pain introduced the process of "previous steaming." His method for the injection of sulphate of iron and sulphate of barium consisted in:

1. Steaming 15 minutes.
2. Vacuum for 10 minutes.
3. Introduction of antiseptics.
4. Pressure of 8 to 10 atmospheres, the latter being continued 40 to 50 minutes.

This was thought to be a notable improvement, more especially when operating upon imperfectly or half seasoned timber, and it rapidly grew in favor.

In 1857 Messrs. Lege and Fleury-Pironnett patented an apparatus for injecting railway ties with sulphate of copper by the steaming-vacuum-pressure process and tried a great many intelligent experiments upon fresh cut, half seasoned and fully seasoned wood of various species, to establish the exact advantage of each step in the process. A commission to examine these results, appointed by the Agricultural Society of Sarte (a French department), tried further experiments, and thus summed up the ascertained advantages of steaming:

Wood, in seasoning, loses a great deal of weight, and yet shrinks but little; the sap ducts lose the evaporated water, and their walls become encrusted with the non-volatile portions of the sap, among which is vegetable albumen, constituting the principal cause of decay. The albumen dried at ordinary temperature, hardens into a horn-like substance, but the application of moisture and gentle heat again dissolves it, and thus re-establishes a continuity of the sap ducts. It is important to reach this result with the least possible amount of condensed water, so as to leave as many voids as practicable to be permeated by the antiseptic solution. This is best accomplished by steaming at temperatures from 212 degrees to 240 degrees Fahr. for 10 minutes to 3 hours, according to the kind and condition of the wood, and by following this up for some 10 minutes with as great a vacuum as possible. The steam penetrates and dampens all the fibres of the wood; it heats and swells it considerably; it carries off, moreover, by a sort of washing, various volatile or soluble substances, and yet it condenses in the wood in such small quantities that the increase in weight is negligible, and sometimes more than overbalanced by the weight of matters extracted.

This, it will be noted, was predicted upon the injection of sulphate of copper. It is believed that steaming before the vacuum was then universally adopted in Europe by all the establishments which injected mineral salts, but those injecting creosote early recognized that the small amount of condensed steam left in the wood resisted to some extent the injection of this oily substance, and the writer believes that the present practice in Europe is not to steam wood intended to be creosoted. In England the timber, much of which has been rafted, is very thoroughly air seasoned. In France and Germany ties are stacked in open piles for 10 to 12 months, during which time some 16 to 25 per cent. of the weight is lost, and then they are in many cases dessicated further in drying ovens (not dry kilns), during which latter process they lose 3 or 4 per cent. more of weight before being transferred warm into the creosoting cylinder. Another method is to boil the ties in hot creosote so as to evaporate the sap and make room for the creosote, which is injected by pressure. This is, perhaps, the best method, laboratory experiments showing that there is still 18 to 20 per cent. of moisture in so-called "thoroughly air-seasoned timber."

For wood to be injected with mineral salts, steaming is generally resorted to in Europe, these salts being in watery solutions, and condensed steam is not objectionable, as it merely weakens the solution, which is made a trifle stronger than would otherwise be the case.

In the United States, Hayford took out various patents for steaming in 1859, 1870, 1872 and 1877, which were hailed as great improvements and went into extensive use even for creosoting. For a time every wood preserver steamed before injection and it is only within the last two or three years that the question has been raised whether better penetration with mineral salts can not be obtained by omitting steaming altogether.

The writer having tried hundreds of experiments duirng the first ten or fifteen years of his practice in the injection of mineral salts, believes that whether it is advisable to steam or not to steam de-

pends altogether upon the condition of the wood when it becomes necessary to inject it. The best practice is to season it thoroughly, but customers are generally impatient and urgently require the treated wood for immediate use. So the operator has often the alternative of either discommoding his client, or of not doing the best work of which he is capable. He not infrequently unloads timber on the ground at his own expense in order to season it a little more.

Wood structure generally contains 30 to 50 per cent. of cells by volume. In the living trees these cells are filled with sap and the problem is how to replace this sap with some preservative substance. In rafting, a small part is washed out by diffusion, and in air seasoning perhaps over one-half of the watery portion of the sap slowly evaporates. It is obvious enough that, in order to inject satisfactory amounts of any antiseptic, a place for this must be found in the wood, and if the sap cells be filled with sap or with water, it is clearly impossible to fill them with another fluid. To clear the sap cells, therefore, we must produce some motive force inside the wood. This motive power may consist of steam generated inside of the wood, or it may consist of air which has replaced so much of the watery portion of the sap as has been evaporated in seasoning, which air is heated and expanded by steaming.

Proceeding upon this theory, the writer tried very many experiments with various species of wood, fresh cut, quarter seasoned, half seasoned or wholly seasoned, by steaming them various lengths of time, they being weighed in and out at each stage of the operation. He found that where the wood was fresh cut and full of watery sap, it required no less than 8 hours of steaming at 20 pounds pressure (258 degrees Fahr.) to bring the center of a tie, 6 by 8 inches section, to the boiling point, or 212 degrees Fahr., at which the sap would begin to generate steam so as to drive out some of the watery portion. It is understood that the creosoters who operate upon fresh cut or waterlogged piles are sometimes compelled to steam for 24 hours, at more than 20 pounds pressure, in order to clear the wood for injection. In that case it is probably safe to begin the operation with steam as high as 30 pounds pressure (275 degrees Fahr.) because the water in the wood, which first evaporates, protects the fibre from immediate injury, but toward the close of the operation the pressure should not exceed 20 pounds, which has been found the point (258 degrees Fahr.) at which small injury to the strength of the fibre is likely to result.

With half seasoned ties, that is, air dried, from 4 to 6 months, according to the time of the year, the writer ascertained the perhaps surprising fact that more sap could be extracted by 1 to 3 hours' steaming than could be gotten out of fresh cut ties by 3 to 5 hours of steaming at 20 pounds pressure. Of course there was more of the watery portions of the sap in the fresh cut ties than in those half seasoned, but it could not be extracted satisfactorily without much longer steaming. It was concluded that when the wood was half seasoned, some air had flowed in, and that this, being moderately heated by the steaming, expanded so as to drive out a good deal of the remaining sap, and this view was confirmed by the examination of the ties immediately upon their withdrawal from the treating cylinder, when minute bubbles of air and sap were observed issuing from the ends of the ties.

With fully seasoned ties, say 6 to 12 months from the cutting, the effect of steaming was sometimes to increase the weight of the ties, and sometimes to diminish it, such increase or loss being, however, very small and well within 2 per cent. It was found that when the ties were in that condition it was best to dispense with the steaming altogether, and to begin with the vacuum, as more solution (chloride of zinc in this case) could be injected than when the ties were previously steamed, which latter operation leaving some condensed steam in the wood (say perhaps 5 per cent. of its weight reduced to 2 per cent. by the subsequent vacuum) diminished by just so much the quantity of solution which could be forced into the tie.

These experiments were made from 1890 to 1900, and were fully confirmed by experiments made in 1904 by Mr. S. M. Rowe. From the results and from experienced gained in regular working, the following practice has grown up at the works of the writer:

1. To refuse to treat fresh cut ties, but to put them down on the ground to season.

2. To begin the spring season's treating by steaming, unless the ties are of previous year's cutting.

3. To omit steaming in the summer and autumn, when the ties prove to be well seasoned.

This practice leaves open the question whether it is important for the best results to first sterilize the germs of decay by heat, either that of steam or that of hot air by drying ovens. Some bacteriologists hold that the germs of decay exist in sap of the wood before it is cut down, and some believe that these germs penetrate into the wood after it is treated. The writer's experience with the

results of ties previously steamed or treated without steaming, is not sufficient to enable him to adduce any facts bearing on this question; but he believes that the European practice of heating wood in drying ovens just prior to its injection is good, and that this may be the next improvement which should be introduced in this country. Be this as it may, he hopes that the members of this association will contribute their experience to the discussion of this paper, and that the result will be to produce still better work in wood preserving.

THE TESTING OF CLAY AND CONCRETE PIPES.

Following are some abstracts of parts of a report of Burchartz and Stock of the royal building material testing department in Gross-Lichterfelde upon tests of clay and cement pipes:

Clay and concrete pipes are bedded in trenches dug in the earth and filled up with earth, sand, etc.; they may be subjected to different pressures.

In order to imitate as fully as possible the strain in such cases, by applying external pressure, the pipes were partly or fully covered with sand or earth or bedded only to a certain height and then loaded on the top. To determine the resistance of pipes against internal water pressure, the two ends of the pipes were closed by iron or wooden covers, with suitable joints (rubber plates) and then these covers were pressed firmly against the ends of the pipes by means of nuts on threaded bolts, after which water was conducted into the interior through one end.

Both methods, however, show faults impossible to control and are for this reason not wholly reliable.

Clay pipes were placed between square pieces of pine, the ends of which had been cut out to suit the shape of the sockets. Any irregularities of the pipes were equalized as much as possible by flat wedges of soft wood placed between the pieces of wood and the pipes.

Concrete pipes were provided on the top with a layer of mortar or of plaster of Paris, 5 cm. broad, being exactly levelled in order that the pressure might be exerted uniformly over the whole length of the crown of pipe. When the mortar had sufficiently hardened, the pipes were placed on a plain cast-iron base, after a layer of plaster of Paris has been placed on the latter, if necessary. It should be noted that the concrete pipes are made with a horizontal surface on which they rest in the trench, which is produced by thickening the pipe on each side near the bottom.

In order to exclude the influence of moisture from the result of the test, the pipes were stored in the laboratory until they were air-dried. The rupture of the clay and concrete pipes takes place more or less uniformly in such a way that the pipes are split into four parts at the top, bottom and sides, where the greatest tensile stress is exerted. The results of the compression test are indicated in kilos as total breaking load. For determining the top pressure a pipe press having a capacity of 20 tons was used, this press permitting pipes of the largest standard sizes to be tested. The press consists principally of the tie rods securely attached to the base plate and carrying above the removable traverse with the hydraulic press. Attached to the press is the traverse which distributes the pressure uniformly over the whole length of the specimen by means of ball bearings. The traverse is adjustable by inserting suitable pieces to obtain the height required. The machine is driven by hydraulic pressure and actuated by the gearing table placed at the side.

The resistance against internal pressure is determined by a method which admits of an easy but sure and reliable closure of the pipe ends by means of leather cups. Cups made of the best grain leather, 5 to 6 mm. thick, and having a rim about 30 mm. high, the edges of which have been sharpened, are placed in the pipe ends and are supported by wooden cylinders fitting smoothly to avoid their being forced through. The specimen thus prepared is then placed in a frame work consisting of two tie rods and two traverses which take up the surface pressure acting on the cups with cylinders. The frame work is bolted by the nuts so that the pipe is not subjected to a longitudinal pressure, but only to an internal pressure acting radially. Pipes up to 19 in. diameter are thus tested. Pipes of larger diameter are closed with wooden bottoms lined with sheet zinc, which fit the rollers used in testing the other pipe.

The pressure required to burst the pipe is given in atmospheres.

Fragments of cement pipes are tested for permeability as follows: After jointing the lateral fracture surfaces by wax, a rim of strong paper about 7 cm. high is placed around them and made water tight by colophonium and wax. In the hollow space thus formed water is poured

TABLE I—CLAY PIPES.

Summary of the Mean Minima, Maxima and Average Values for Resistance against Pressure from Outside and Inside.

		Resistance against external pressure. —Breaking load, lb.—				Resistance against internal pressure. Water pressure, atm.				
Average inside diameter, in.	Av. thickness in pipe material, in.	Number of individual tests.	Average of Minima values.	Average of Maxima values.	Total average.	Number of individual tests.	Average of Minima values.	Average of Maxima values.	Total average.	Tangential stress lbs. per square inch.
2	0.72	3	9900	10160	9990	3	24.0	28.0	26.1	490
3	0.80	3	4140	5760	5350	3	15.0	18.4	16.3	490
4	0.68	10	2530	7590	5790	11	9.2	25.2	20.1	830
*6	0.80	31	2330	8800	5980	23	8.3	24.5	17.2	850
8	0.92	10	2530	7480	4330	13	14.6	24.2	17.9	1120
10	0.96	7	1890	9920	5100	2	6.0	8.0	7.0	600
12	1.04	17	2540	8030	5960	19	6.7	16.9	11.9	920
16	1.12	4	5720	8840	7280	2	9.4	9.7	9.6	910
18	1.28	6	4380	4620	4510	8	7.1	12.0	9.3	920
20	1.44	10	4180	10600	7720	4	9.0	12.2	10.6	1040
24	1.72	3	5390	7590	6490	7	5.3	8.6	7.2	720
28	1.88	3	6820	7590	7210	4	7.1	10.2	8.7	910
32	1.96	7	5720	7650	7000	14	5.4	9.0	7.7	1120
Average.....					6400				13.9	850

*Including pipes of 6.2 and 6.4-in. diameter.

TABLE II—ROUND CONCRETE PIPES.

Summary of the Mean Minima, Maxima and Average Values for Resistance against Pressure from Outside.

		Resistance against external pressure. —Breaking load, lbs.—				
Average inside diameter, in.	Average thickness of pipe material, in.	Number of individual tests.	Average of Minima values.	Average of Maxima values.	Total average.	Resistance against internal pressure. Average.
8	1.40	3	4140	7240	4550	8.8 atmospheres.
12	1.92	10	4160	14410	9510	0.49 " 4.3 "
16	2.16	22	3540	13240	8120	——
18	2.24	6	7990	8110	8050	——
20	2.44	21	3720	12560	6750	2.8 " 2.9 " 4.4 "
24	2.80	9	5280	12540	7960	——
28	3.20	2	7260	12980	10120	2.7 "
32	3.40	7	6780	7550	7170	——

to a height of 5 cm., observing whether water trickles through in drops or is otherwise exuded from the specimen. This observation lasts three days, if no other time is fixed. The clay pipes are considered practically water tight.

Pipes carrying sewage are, especially when laid on steep grades, not only worn

by the action of the water flowing through them, but also more especially by the grinding action caused by the sand and similar particles carried away with the water. The resistance of pipe material against abrasion is therefore of importance. To determine this property the well known Bauschinger grinding method has been employed, but the sand blast apparatus is now used for this purpose.

To determine the action of frost on the materials, fragments of pipe are saturated with water and alternately frozen 20 hours at 12 to 15 degrees below Centigrade zero and thawed for 4 hours in water at room temperature 25 times.

To determine the strength of pipe material, cubes are cut out of the pipes with stone saws and tested on hydraulic presses in the usual manner, after the pressure surfaces are planed either by grinding or by placing on them a layer of cement mortar. It may be of interest to mention that the compressive strength of clay-pipe material cubes tested in the above-mentioned laboratory fluctuated in radial strain between 8,260 and 10,890 lbs. per square inch and in tangential strain between 19,350 and 23,990 lbs. per square inch. These figures showing the compressive strength of clay-pipe material averaged in two cases between 2,440 and 3,480 lb. per square inch.

The minima, maxima and average values of compressive strength of clay pipes and of concrete pipes, with loads on top are given in tables I, II and III.

The following conclusions are drawn from the results of the tests that have been made: First with regard to clay pipes (a). Without considering the exceedingly high average value for top pressure of 2-in. pipes, the average values of the other pipe diameters show proportionally low differences; they fluctuate between 4,500 and 7,720 lbs. per square inch and the medium of all average values is 6,400 lb. (b) Any true relation between the values of top compression and the internal diameter cannot be deduced from the breaking loads. (c) With pipes up to 8 in. diameter the values found for interior compressive strength are far higher than those found for pipes of larger diameter. The average of the averages for the smaller sizes amounts to 19½ atmospheres and for the larger to 9 atmospheres. (d) The mean tangential stresses calculated from the average number of atmospheres for internal pressure fluctuate between 400 and 1,120 lbs. per square inch, the lowest individual value being 300 and the highest 1,700 lbs. per square inch.

Without regard to the low values for the 2 and 3-in. pipes and to the values for the 10-in. pipes, which are less reliable, due to the small number of individual tests, the stresses do not show great differences, 415 to 1,120 lbs. per square inch. The mean stress calculated for all average values amounts to 850 lbs. per square inch.

Second, with regard to concrete pipe: (a) as far as the small number of individual tests admits of a conclusion, the resistance of the concrete pipes against outside compression varies to a great extent even with pipes of equal size, as is also the case with clay pipes. (b) The average compressive strength of concrete pipes of various dimensions shows somewhat greater variations than with clay pipes; they average with round pipes between 4,560 and 10,120 lbs. and with oval pipes between 9,260 and 12,540 lbs. total load. The total average of the top compressive strength is with round pipes 7,790 lbs. and with oval pipes 11,500 lbs. (c) Reliable conclusions regarding the resistance of concrete pipes against internal pressure cannot be drawn because the number of the individual tests made is too small. The maxima and minima values found in one case each for the internal pressure amounts to 0.49 and 10.2 atmospheres.

In the case of the resistance against external pressure, the concrete pipes, as may be seen from the actual results, give with the method of testing applied generally higher average values than with clay pipes. The less favorable behavior of clay pipes compared with concrete pipes is by no means due to worse quality of material, in other words to lower compressive strength of material, but, disregarding the probably greater brittleness of the clay-pipe material, is due to the

TABLE III—OVAL CONCRETE PIPES.

Summary of the Mean Minima, Maxima and Average Values for Resistance against Pressure from Outside.

Average inside measurements, in.	Average thickness of pipe material, in.	Number of individual tests.	Resistance against external pressure. Breaking load, lb. Average Minima values.	Average Maxima values.	Total average.
14x21	2.60	2	11960	13110	12030
16x24	3.00	1	—	—	11220
20x30	3.00	11	11960	15770	12650
24x36	3.72	3	11000	11680	11350
28x42	4.00	9	6010	19450	12320
32x48	4.00	2	4360	14930	5500
40x60	5.20	2	6160	12360	9260

circular shape of clay pipes, making them more unfavorable for the strain exerted when tested under pressure, for with the concrete pipes the pressure acts in the bottom of pipe on a large area, while with the clay pipes the pressure is exerted on a very small area only, both in the top and bottom; besides this, with concrete pipes a larger bearing surface is created for the distribution of the load in the top by applying a layer of cement mortar 2 in. wide.

As a matter of fact, the material of clay pipes is, as proved by the results of compression tests made with clay-pipe cubes, far more solid than that of concrete pipes. Assuming even the richest mixture, best raw materials and most careful manufacture, the material of concrete pipes will scarcely obtain the least compression strength found for clay pipes, 8,260 lbs. per square inch, and certainly not a compressive strength of 14,200 or even 28,400 lbs. per square inch, figures which have been found with clay-pipe material. The results published show that the clay-pipe material has practically proved to be water tight and acid proof. Even the concrete-pipe material tested has been found impermeable; the pipes put under investigation were, however, coated with tar. When exposed to the action even of weak acids the concrete-pipe material did not prove to be very resistant, as, for instance, 1¼ per cent. acetic acid, and still more 1¼ per cent. hydrochloric acid, exerted a rather strong dissolving influence on the cement of the concrete. Salts are not injurious to the concrete-pipe material.

Regarding the resistance of pipe material against wearing out, reliable data cannot be given. The loss of material in testing with the sand blast fluctuates in the one case for clay pipes of the same origin, but different in size, 6, 10 and 16 in. internal diameter, between 0.70 and 0.88 cu. in.; in the average it amounts to 0.78 cu. in., and in another case the abrasion averaged 0.71 cu. in.

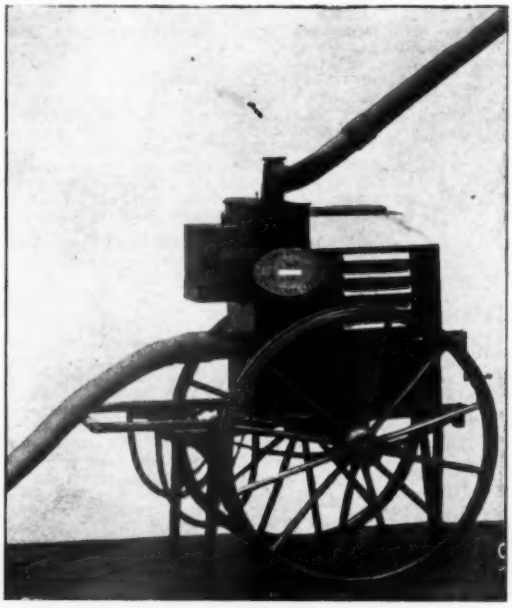
A NEW ENGLISH GASOLINE MOTOR PUMP.

By Frank C. Perkins, Buffalo, N. Y.

The accompanying illustration shows a new and interesting applicaton of the modern gasoline motor in the form of a portable centrifugal pump suitable for drainage or irrigation and capable of dealing with water or sewage.

This combined petrol motor and centrifugal pump is of a balanced high efficiency type mounted upon a hand spring cart and constructed at Leeds, England, by Hathorn, Davey & Co. Ltd. The smallest equipment is designed for delivering 120 gallons per minute a height of 30 feet, the largest amount of water handled by this unique gasoline motor driven pumping equipment being 660 gallons of water per minute a height of 10 feet.

The suction pipe is 15 feet in length of the flexible armoured type with foot valve and strainer, a metropolitan instantaneous union being provided for attachment to the delivery hose. It is stated that the lubricating oil and gasoline tanks are sufficiently large for a run of several hours without refilling and when charged, this combined gasoline motor centrifugal pump can be started at a moment's notice and requires but little attention.



As noted in the illustration the motor and pump are entirely enclosed, a small crank permanently connected for starting projecting from the case, as in an automobile engine, being provided.

EDITORIAL COMMENT

New Forms of City Government.

The Sanitary Engineer and the Death Rate.

The Defeat of the Proposed Chicago City Charter.

NEW FORMS OF CITY GOVERNMENT.

The Boston Evening Transcript and the Indianapolis Evening News in discussing the editorial in a recent number of MUNICIPAL ENGINEERING bearing the above title, take positions opposed to each other regarding the Galveston and Des Moines plan of city government by commission, and agree fairly well in their opinions regarding the Indiana and Boston plans which have a mayor responsible for the administration and a council as a legislative body with power to act as a check upon the administrative departments if they choose to exercise it.

Regarding the Des Moines plan the Boston Transcript says:

This has gone into effect in Des Moines, and its features are criticised by MUNICIPAL ENGINEERING which makes points that seem to us well taken. There is no balance of government. The members of the commission make the ordinances that they themselves execute. They pass upon all appropriations, spend the money and approve the expenditures, and this suggests that with corrupt commissioners the city would be at their mercy. The remedy provided of electing other men in their places in such an event might work, and it might not, or it might be employed to persecute as well as to reform, because "the process is so complex and the appeal is so likely to be put on political grounds, that its practical application with good effect is very doubtful.

The Indianapolis News regarding the Galveston plan says:

This plan, as we have frequently set out, is the election of five commissioners, who elect one of their number as head or mayor, and who apportion all of the city business into five departments, each taking charge of one. They legislate and execute. That is, they are council and executive, meeting to decide on the common needs, passing the laws and carrying them into effect. The plan has worked perfectly in Galveston, but that is a small town and the new method was adopted at an extraordinary crisis when the city had been all but destroyed by a tidal wave. Now Des Moines, a city of nearly a hundred thousand, is to try it. MUNICIPAL ENGINEERING criticises it (in advance, as the trial is yet to come), because there is no balance of government, and it is urged that with corrupt commissioners the town would be at their mercy. The question might be asked if that would not be the case with any form of government. We note here that in England, where municipal government is uniformly as great a success as with us it is a failure, practically this form is the universal one; that is, there is a governing board, consisting of a dozen or a score of men who serve without pay. This board does just what this Galveston plan does with its commissioners—passes and executes the laws.

Regarding the Indiana plan the Transcript says:

Theoretically that is a very pretty plan. It concentrates responsibility, but it also holds out tempting opportunity to the repository of such responsibility, which, unfortunately, is sometimes too well improved. It provides condtions favorable to the building up of boss-ships. It is just now the Boston as well as the Indiana method, and we believe that scandals of generous proportions have occurred under it even in the principal city of that State. There is no automatic way of making a city clean and prosperous. It cannot be done by machinery or by systems; it must be done by men, if at all. It is as true today as when Pope penned the lines:

"For forms of government let fools contest;
Whate'er is best administered is best."

The Indianapolis News quotes from this approvingly and closes its comment with the following:

With a mayor determined to do his duty our form of government is admirable. But nothing takes the place of honesty of purpose. Nothing prevents dishonest contracts for supplies and work and keeps out graft except honesty. We shall all of us—we American cities—hunt in vain for any form of government that shall take the place of that and with that, almost any form would do. The Galveston plan, we should think, would have a better chance of success than most in spite of the criticism of MUNICIPAL ENGINEERING, for the simple reason that it allows fewer factors. It does not permit a Council, for instance like the present body in Indianapolis, and it puts all responsibility—executive and legislative—on five men. Surely five good men can be found in any community.

If we will all go to the fundamental principles upon which city government should be based and will consider in addition the conditions which we find in cities of various sizes, the apparent differences of opinion in the three editorials will largely disappear.

For many years, and with increasing

pleasure over the growing sentiment in this direction, this magazine has contended that the municipality is primarily a business organization which should be conducted upon business principles and should be removed as far from partisian politics as possible. When conditions become so bad in a city that there must be a change, we have the Indianapolis plan, the Galveston plan, the San Francisco plan, the New York plan, devised to meet the emergency. So long as these plans are operated on business principles they are successful. When politics again gets its hold the success is limited and in inverse ratio to the efficiency of the checks which we put upon the administrative officers. The Indianapolis plan operated longer with good success than any of the others, largely because the people kept their hold upon the check rein longer, and it has better chances for future success than many of the others because the people can get hold of the reins again at any time they wish, and because, even under a political flood, a small body of influential citizens can at any time close the gates at least partially and prevent complete disaster.

Like every other business organization, the city is served as well as its stockholders, the voters, desire. If they as a whole do not know what they want or what is good, they are at the mercy of the self-seeking men who play politics for the purpose of concealing the real issues and putting up those which will take the voter's eys. The remedy is education. Meantime, the palliation is to be found in thorough checks upon the action of the cty's chosen representatives and the localizing of responsibility so that no one can escape the consequences of his wrong doing or mistakes by shifting it upon other shoulders. Thus the mayor, in Indiana, is responsible for the administration. If any of his appointees fail in their duty he can remove them. Whether he does or not, he is responsible for their acts. He can do nothing if the council refuses to give him the funds, but he is responsible when he is given the funds to spend. The council has the right to investigate and thus to check misfeasance or malfeasance at any time. The individual citizen has the right to investigate and publish the results. In fact, the voter and taxpayer has more power to influence the operation of the municipality than the ordinary stockholder has in a business corporation. If he does not exercise it he has himself to blame. Clearly, the smaller city can be better governed than the larger city, actually it seldom is. Various investigators have reported that the municipality is less subject to the influences of graft, nepotism, favoritism, petty politics than the average corporation and, in proportion to the sums of money handled is better administered, if not quite so economically. When we want better government we can have it.

The Indianapolis News does not go far enough into the conditions in Great Britain to show the differences from those in this country. The English city is really operated as a business corporation. The franchise is limited to those who have an appreciable financial interest in the city, and consequently the average of the voters is higher in intelligence, more interested in good government. The average English city elects its Board of Directors who elect their President, thus carrying out the analogy to the business corporation. If our suffrage, for municipal purposes, were restricted to the actual stockholders, owners of property enough to pay an appreciable tax, our average voter would also be more intelligent.

Then too, the checks upon municipal operations come largely from without. The central government has much closer oversight over the operators of the municipality than our municipalities now have. This class of checks might well be introduced along with the supervision of public utilities as in Massachusetts, New York and Wisconsin, and as has been done to some extent in Ohio.

Evidently the three editors agree upon the proposition that honesty of the city admnistrators is the first requisite. Where the voters are so, indifferent and the balance of power among them is so venal that the election of honest officials is difficult, the necessity of checks is admitted by all. The only difference of opinion is regarding the nature of these checks. The consideration of the supervision of municipal accounts and financial operations by a central state board of experts, similar to the English custom and in amplification of the Ohio system is in order. It has had but little trial in this country and may on that account be attractive to those who do not see the advancement due to the methods now in use.

THE DEFEAT OF THE PROPOSED CHICAGO CITY CHARTER.

By a majority of two to one on a poll of almost exactly half the voters, the city of Chicago on September 17 defeated the adoption of the proposed new charter for the city, at the same time that a proposition to improve the municipal courts was carried. The concise statement of the essential features of the charter made by Frank L. Shepard, one of its earnest advocates follows:

I consider the defeat of the charter a great loss to Chicago. All of its essential features have been demanded, will be demanded and will ultimately be re-obtained and adopted by the people. This is necessarily so, for they are required for the city's growth, development and proper administration.

These essential features are: First, the consolidation of the eighty-nine parks and playgrounds and thirty-five boulevards into a single district, under a single board, responsive to the people of Chicago and maintained out of a single fund, in lieu of the several districts, under separate, independent authorities.

2. A consolidated tax levy for all city, school, park and library purposes, under a reasonable and permanent aggregate limitation, in place of the separate levies now made, with the uncertain and cumulative burden.

3. The ability to build permanent public improvements out of bond issues, spreading the cost over a period of years, instead of building out of the annual tax levy for current purposes.

4. The proper division of the cost of street pavements between the general public and the abutting property owner.

5. The power to legislate locally for local affairs.

I believe all of these will be adopted, either separately or collectively, and practically as tendered in the charter just rejected.

All of these are strong reasons for the adoption of the charter, but, apparently, some defects and some fancied defects operated more strongly than these pronounced advantages.

The charter was first adopted by a convention which admitted some weak provisions in its desire to secure the insertion of those of most importance This charter went to the legislature of the state where it was modified, largely for political purposes, so that it came back to the city with the Democratic party almost solidly against it, and so many organizations interested in the sections omitted and opposed to those inserted joined in adverse votes as to produce the decisive majority against the document as a whole.

The most prominently mentioned objections to the charter were the ward boundaries and numbering, evidently arranged for political advantage to the party now in power in the state; the elimination by the legislature of a number of provisions regarding methods of nomination and election; the fear of some that their "personal liberty" would be abridged by omitting provisions regarding Sunday operation of saloons and clubs; the increase in tax rates made possible; fear of weakening the civil service, getting the school board into politics, etc.

Some of these not based on fact and, while the tax rate would under the provisions of the charter be increased, the amount of increase was definitely fixed, so that the expense of operating the city government was more carefully guarded than at present.

It is reported that the advocates of the charter will try again, believing that if some approximation to the form of charter as prepared by the charter convention can be presented to the voters it will pass.

Professor C. E. Merriam, of the University of Chicago, says:

Chicago evidently wants a new dress, without partisan political trimmings. The voters thought they saw a straitjacket in the folds of the garment presented. The charter sent by the convention to the legislature was acceptable to all factions and all parties, and would have been adopted with but little opposition.

The ward gerrymander inserted at Springfield aroused the active opposition of the Democratic organization and made the defeat of the charter inevitable. The elimination of the charter provisions for direct primaries, publicity regarding campaign funds, abolition of the party circle, extension of civil service to employes of the Municipal Court, and the election of Municipal Court judges in June instead of November, created widespread distrust and opposition among the electorate. The failure to enact the charter provisions regarding Sunday opening offended a large class in the community.

In my judgment, the partisan feature of the charter unquestionably defeated it. The moment the controversy reached the partisan stage, the rejection of the charter was certain. Personally, I believe that the charter contained a great deal more good than evil, and that its adoption would have been, on the whole, a benefit to the City of Chicago.

It is possible to make a better charter, and the work should be begun at once. I should like to see the legislature, in the October session, submit a constitutional amendment authorizing all cities in the state of Illinois to frame their own charters subject to a few simple restrictions. Such an amendment would doubtless meet the approval of a large majority of

the electorate of the state and would enable Chicago and other cities to deal properly with their local affairs. Instead of this, the legislature might provide for an elective charter convention of say, 100 members, with power to frame a charter, subject to a referendum vote.

THE SANITARY ENGINEER AND THE DEATH RATE.

Many diverse statements are made regarding the effect of modern sanitary science and its applications upon the death rate, and they doubtless all of them can claim some justification in the limited collections of fact upon which they are based, but the fact that they are deductions from partial information is not prominently displayed and therefore the discrepancies in the statements are not explained.

In a paper by Dr. Erastus G. Smith on "Urban Tendencies of Population as Affecting the Problems of Engineers," presented last year to the Western Society of Engineers, he shows in a table that the death rate in Chicago in the decade from 1896 to 1905 was 14.71, in that from 1876 to 1885 was 20.30 and in that from 1866 to 1875 was 23.86 per thousand of population per year. The decrease from 23.86 to 14.71 he computes to be an improvement of 38 per cent. In another table he states that the average age at death has increased from 16 years, 2 months, 12 days, in 1875, to 20 years, 4 months, 26 days, in 1885, to 24 years, 7 months, 9 days, in 1895 and to 31 years, 10 months, 1 day, in 1905. He also says that in 1875 only 3.7 per cent. of those who died were over 60 years old and that in 1905 19.6 per cent. were over 60, 10.1 per cent. were over 70 and 3.2 per cent were over 80, or that in 1905 nearly as many were over 80 years old as were over 60 in 1875.

Dr. Smith argues improved sanitation as the reason for these remarkable figures, and doubtless this accounts for much of the improvement in the death rate, but the increase in age of decedents is so much greater than the reduction in death rate that it cannot all be accounted for by the work of the sanitarian. There are several suggestions of inaccuracies and lack of information which throw much doubt upon the odd days of the ages at death, not to speak of more material discrepancies. It is well known that for many years the collection of vital statistics in Chicago was incomplete and inaccurate and that data now given are much more satisfactory than those only a few years old. Dr. Smith states that 882 deaths in 1905 were of persons over 80 years old. The health reports for that year give 887 as the combined number of those over 80 and of unknown age, so that either Dr. Smith's figure is inaccurate or there were but 5 whose age at death was unknown.

In the discussion of the paper reduction in number of railroad accidents was suggested as one reason for reduction in death rate, and greater ability of invalids to travel to other climates of late years as another.

The most obvious reason for a material increase in age at death was not suggested, viz.: that while the city is growing rapidly, the additions to the population are disproportionately young, few old people coming in in proportion to those of youth or middle age and in later years these people have grown old so that the proportion of old persons has materially increased..

In one of the literary monthlies a statement has been made that the reduction in death rate is due to better sanitation among children, but that the death rate among persons of middle age has actually increased, and it is claimed that this is due to the strenuous life of our modern civilization which takes the young men, particularly, who have been saved by the better conditions in infancy and wears them out before the period of middle age has passed.

Both these discussions are incomplete because they have considered only a part of the data and their conclusions are incorrect in so far as they fail to cover the whole ground. A few figures which happen to be at hand will show perhaps more clearly how the selection of data for consideration may modify the conclusions, and that still more data must be compiled and considered before any really valuable conclusions can be drawn.

Assuming a median age for each 5-year period in the U. S. Census tables as the average age at death in that period it will be seen that the average age at death of those reported in the census of 1890 was 29.47 years and of 1900 was 33.70, showing a material increase in the age at death for the country at large.

From the State Board of Health reports of Massachusetts, made for most of the cities and towns over 5,000 population, by the same process it can be computed that the age at death in

that state was 33.3 years in 1895 and 34.4 in 1900, showing an appreciable increase in 5 years. The figure for Massachusetts from the U. S. Census report for 1900 is 36.83, still higher, but it includes rural population.

From the same source it is computed that the average age at death in Boston was 31.0 in 1895 and 33.2 in 1900, again showing an increase.

These increases are not by any means as large as those reported by Dr. Smith for Chicago. If the theory stated is correct they would not be, for the increase in population in Massachusetts, in Boston or in the country at large has not been proportionately as rapid as in Chicago and the disproportion of persons in youth and middle life is not so great.

To show the ease with which errors may be made in accepting figures with insufficient knowledge of their value, the following are given, showing the variations in the age at death shown in the U. S. Census reports for 1900 according to grouping of returns:

The rural part of states having systems of registration of vital statistics shows age at death 44.7 years.

The whole of these states shows 36.9 years.

The cities in these states show 32.4 years.

Cities which have registration systems and are in states having no registration show 32.6 years.

All cities having registration show 32.9 years.

All states and cities having registration systems show 35.3 years.

The part of the United States having no registration system and whose only statistics are for the census year shows 32.3 years.

The United States as a whole shows 33.7 years as the average age at death.

With reference to the distribution in saving of life due to reduction in death rate of children, the following figures may be of interest. They are taken from the U. S. Census and represent the improvement in the whole country as shown by those returns. Apparently similar results might be obtained using the returns from cities and states having systems of registration of vital statistics, but these figures are used because the Census reports also contain the statement of the number living in each age group as well as of the number of deaths, and this is required to aid in the explanation of the observed facts. The death rates are per 1,000 and the statement of those living is per 1,000 of population.

It will be noted that there is a material saving in the death rate of infants and youths which extends to the age of 35 and amounts at that time to 62.4 persons per 1,000, three-fourths of which saving is in those under 5 years of age. This saving must of course be counterbalanced by a corresponding increase in relative death rates for ages greater than 35, and this is shown in the last column of the table, the relative loss increasing with few exceptions from age 20 to age 75, but there being no material evidence of particularly heavy mortality until age 65 is reached, except that the period 55 to 59 shows larger than either side.

The columns showing relative number of those living in each age period show a similar condition. There are fewer per 1,000 at ages less than 25 in 1900 than in 1890 and there are more at each age up to 80, the number above 80 being practically the same in each census report.

On the whole then, the indications of this table are that the saving in child life, due undoubtedly to better sanitary conditions, is very appreciable, and this saving leads to the necessary increase in death rates of older persons, which is reasonably well distributed in a curve which reaches its maximum at about 75 years.

DEATH RATE AND AGES OF LIVING POPULATION.

FROM U. S. CENSUS REPORTS.

Per 1,000 of Population.

Age Periods.	1890		1900		
	Death Rate.	Ages of Living.	Death Rate.	Ages of Living.	Reduction. — Increase. +
Under 1	227.6	25.1	193.2	25.3	—34.4
1	60.1	17.2	58.0	23.3	— 2.1
2	31.8	27.7	27.3	24.1	— 4.5
3	20.4	26.1	17.1	24.0	— 3.3
4	15.2	26.1	12.2	24.1	— 3.0
Under 5	355.1	122.2	307.8	120.8	—47.3
5— 9	43.0	121.3	35.6	117.0	— 7.4
10—14	25.8	112.6	23.8	106.5	— 2.0
15—19	39.7	105.0	36.9	99.7	— 2.8
20—24	51.4	99.2	49.4	97.2	— 2.0
25—29	47.7	83.7	47.2	86.3	— 0.5
30—34	42.9	73.3	42.5	73.4	— 0.4
35—39	41.6	61.9	43.0	65.5	+ 1.4
40—44	36.9	51.0	40.2	56.0	+ 3.3
45—49	36.5	43.7	39.0	45.5	+ 2.5.
50—54	37.4	37.2	41.4	38.8	+ 4.0
55—59	35.0	26.8	41.8	29.1	+ 6.8
60—64	41.2	23.3	46.7	23.6	+ 5.5
65—69	41.6	16.2	50.6	17.2	+ 9.0
70—74	41.2	11.2	51.4	11.7	+10.2
75—79	35.1	6.3	44.6	6.8	+ 9.5
80—84	26.1	3.3	32.8	3.3	+ 6.7
85—89	14.1	1.2	16.7	1.2	+ 2.6
90—94	5.3	0.4	6.0	0.3	+ 0.7
95 up	2.4	0.2	2.6	0.1	+ 0.2
	1000.0	1000.0	1000.0	1000.0	0.0

Possibly more accurate figure from states having registration systems would give different results and possibly such accurate figures from cities would show the effects of the "strenuous life." Because the country at large shows little or no such influence is no warrant for applying these results too closely to a particular district.

THE QUESTION DEPARTMENT

BOOKS ON SEWAGE DISPOSAL.

Please inform me what is the best treatise on the modern theory and practice of disposal of sewage. If possible would like a work treating in detail of the various approved methods. methods.

B. S. REEVES,
Guthrie, Okla.

Probably the best book on this subject is Dibdin's "Purification of Sewage and Water" ($6.50). It is an English book, but as most of the recent advances in sewage purification have been made in England, it has descriptions of the modern methods. The methods described in the book are not always strictly applicable to American conditions, but there is no book on American methods of sewage disposal new enough to show the most recent advances. Rafter and Baker's "Sewage Disposal in the United States" ($6) gives descriptions of the plants and methods in operation in 1894, but most of the modern methods have developed since that date. The best source of information about what has actually been done in this country is MUNICIPAL ENGINEERING, which contains in its back volumes descriptions of plants using all the approved methods. Long lists of such articles will be found in vol. xxxi, p. 281. Another excellent article is the one entitled "Advance in Sewage Purification," in vol. xxxi, p. 439. These articles are devoted largely to the septic tank and filtration methods, which are the most popular at the present time.

SEWAGE DISPOSAL FOR RURAL RESIDENCES AND VILLAGES.

Please give us a list of articles in your magazine on sewage disposal for rural places and small villages.

MECKLENBURG IRON WORKS,
Charlotte, N. C.

In vol. xxxi, p. 281, is a long list of articles on septic tanks and sewage filters, several of which are directly in answer to this request, such as the following:

"The Septic Tank of the Champaign Sewerage System," vol. xiv, p. 93; vol. xvi, pp. 158 and 176.

"The Experimental Septic Tank at Altoona, Pa.," vol. xxiii, p. 193.

"Experiments with Septic Tanks in Pawtucket, R. I.," vol. xx, p. 163.

"Septic Tanks at Glencoe, Ill., vol. xxii, p. 1.

"Septic Tanks at Vancouver, B. C.," vol. xxii, p. 208.

"The Septic Tanks for the Treatment of Sewage at the Soldiers' Home near Santa Monica, Cal.," vol. xxvi, p. 1.

"Residential Septic Tanks," vol. xxiii, p. 355.

"Cost of Small Septic Tanks," vol. xxiv, p. 432.

"Individual Septic Tank System," vol. xxv, p. 90.

"Residential Septic Tank System," vol. xxv, p. 179.

"Sewage Purification Plant at the Indiana Eastern Hospital for the Insane," vol. xxvi, p. 178.

"Tanks for the Sewage of Small Towns," vol. xv, p. 101.

"Sewage Purification Plants in Ohio," vol. xxvii, 34; vol. xxviii, p. 279.

"The Sewage Disposal Plant at Downer's Grove, Ill.," vol. xxi, p. 48.

BOOKS ON SEPTIC TANK—SEWER CLEANING MACHINERY.

Please send me the name of the best book on septic tanks in the matter of sewage disposal. Also where I can get jointed rods for the use of getting ropes or wire from manhole to manhole for the purpose of cleaning sewer pipe. Also pans to pull through and something to cut roots that get into sewer pipe.

A. O. H., Hartsville, S. C.

For the answer to the first question see the article in this department en-

titled "Books on Sewage Disposal."

Tools for cleaning sewers can be obtained of the Contractor's Tool Co., Philadelphia, Pa., and Harold L. Bond & Co., Boston, Mass.

BOOKS ON MINE SURVEYING.

I am looking for a good practical book on the subject of mine surveying of coal mines. If you have such book on your list quote me price.

J. A. CARR,
Petersburg, Ind.

Good chapters on mine surveying will be found in Nugent's "Plane Surveying" ($3.50), Gillespie's "Higher Surveying" ($2.50) and Johnson's "Surveying," ($4). Books devoted wholly to mine surveying are O'Donohue's "Colliery Surveying" (85 cents), Fenwick and Baker's "Subterraneous Surveying" ($1.25), Brough's "Mine Surveying" ($2.25), and Lupton's "Mine Surveying" ($5).

FORMS FOR KEEPING COST OF PUBLIC WORK.

I want to inquire of you if you have blank forms to keep time and cost of work on. I will tell you what I have to do, and you will understand what I want. I have some twenty-five or thirty miles of concrete sidewalk to lay, ranging from 3 to 12 feet wide. I have to make a daily report of cost of labor, different classes of labor, team work, cost of materials and grading for walks. I want it so I can foot up just how much was laid and costs of all labor and material at night.

J. E. ENDICOTT, Street Commissioner,
Marshall, Tex.

The writer knows of no book on the market exactly adapted to keeping cost of cement walk work. A time book can easily be adapted to the work. If the jobs are short a weekly time book can be used. If they are long a monthly time book would be more satisfactory. In the column of names can be put the names of the laborers and in the columns of days the numbers of hours put in; then the names of teamsters with hours; following these with the names of the various materials used, each on one line, with the unit of measurement, putting in the columns of days the amounts used each day, such as sacks of cement, loads of sand, gravel, stone, cinders, etc., feet of lumber, tools purchased or rented or depreciation charge on them. More lines may be used for giving length of walk and area of walk laid each day, and a line can be used for materials sold. There is a column in the ordinary time book which can be used for summing up the time or quantities on each line, a column for writing in the cost per unit, and another for the total cost for the item on each line. One or more pages can be used for each separate job according to magnitude and duration.

Another method of arrangement is to write the items at the heads of the columns instead of in the first column as above. In the first column can be written the names of the jobs on hand and in the columns will be entered the same quantities as above enumerated, except that they will be in horizontal lines opposite the names of the jobs instead of in vertical lines under the days of the month. This method keeps all the work of all the jobs for a single day on the same page or double page, and there will be a page for each day.

The first method keeps each job separate and the cost of each job can be computed separately and readily. The second method keeps each day's work separate and the items must be rearranged in the office to give the cost of each job. It is the convenient form for daily reports.

Both forms can be worked together, the record during the day being kept by the first method and the daily report being written up from this in the second form for sending to the office. Each foreman on a job can keep his own job on one page or sheet, and both forms can be written up at night from the foremen's reports with the additions from superintendent's and office reports of special labor, materials and expenses and the pro rata of superintendence, office and other general expenses.

COST OF INDIANA ROADS.

In your August number on page 115 appears an article on "Public Road Improvement" in Indiana, and in the article certain figures are given as the average cost of this work. Can you advise me how I can get at the details? Is there any report published by the State or any of the Counties on these details, and if so, can you tell me how I could secure a copy?

W. W. CROSBY,
Chief Engineer Highway Division Maryland Survey, Baltimore, Md.

A table prepared by J. A. Harding and J. F. O'Brien for the Indiana Engineering Society and printed in the proceedings of that society for 1902, gives reports from thirty-two county surveyors, sent to the committee, and forty-two other counties obtained from the state geologist, with no report from sixteen counties. The average cost of gravel roads is reported from

21 counties. It ranges from $1,000 to $2,900 and, according to the committee report, averages $1,995.26 per mile. The average cost of macadam or stone roads is reported from 18 counties. It ranges from $1,500 to $4,000 and averages $2,402 a mile. This report is for 1901. From the circular of the Office of Public Roads, U. S. Department of Agriculture, on Public Roads of Indiana, 1904, are obtained the figures given in the article on "The Good Roads Movement," on page 180 of the September number of MUNICIPAL ENGINEERING. If these figures are combined with those in the last report of the Indiana State Statistician the following results are obtained:

From the former publication it is found that the total cash expenditure from taxes for road construction and repair in 1904 was $2,095,970. From the latter, the payments for repairs, including viewing and surveying were $928,801. This leaves $1,167,169 as the expenditure for construction from tax funds. From proceeds of bond issues the expenditures were $1,342,418, according to the former publication, making $2,509,587 expended for new construction. From the latter source it is learned that 1,025 miles of road were constructed in 1904. This makes the average cost of roads built in 1904 $2,448 a mile, no distinction being made between gravel and macadam roads.

The most complete report on Indiana roads is contained in the report of State Geologist W. S. Blatchley for 1905, the thirtieth annual report of the department. Over 1,000 pages of the report are devoted to descriptions of the deposits of road making materials in all the counties of the state, with some statement of the extent and character of improved roads in each county and numerical statistics. There are reports from all counties.

The mileage of public roads varies from 160 in Ohio county to 1,500 in Washington county, the total for the state being 68,285.

The mileage of improved roads varies from 0 in Dearborn county, the only improved roads in that county being 20 miles of toll roads, and in Perry county, to 800 in Marion county, in which Indianapolis is situated. There are 24 counties with more than 400 miles each of improved roads, and the total in the state is 23,937 miles, or 35 percent of the total mileage.

The percentage of improved roads varies from 0 in Perry county to 89.6 in Union county. There are 24 counties with more than 50 per cent of their roads improved.

The mileage of gravel roads is 800 in Marion county and there are 80 counties of the 92 with gravel roads and 22 counties with more than 400 miles each. The total mileage of gravel roads is 20,582 for the state, or 86 per cent of the total improved roads.

The average cost of gravel roads varies from $315 per mile in Marshall county (450 miles of gravel road and 800 miles of public roads) to $3,500 per mile in Madison county (325 miles of gravel road and 900 miles of public roads). The average cost for the state at large is $1,403.

The mileage of stone roads in the 54 counties having them varies from one-half mile in Steuben county to 300 in Putnam county, where there are many stone quarries. The total mileage of broken stone roads in the state is 3,355 or 14 per cent of the total improved roads.

The average cost of broken stone roads varies from $993 in Clark county (136 miles) to $4,330 in Lake county (87 miles). The average cost for the state at large is $2,221 per mile. No deposits of road material have yet been discovered in Lake county and the materials for its gravel roads, costing $3,013 a mile, and its broken stone roads have been shipped in from Illinois.

The total cost of improved roads in the state to the date of this report is $36,065,841, an average of $1,507 a mile.

There are now only 112 miles of toll road in the state, in six counties, five of them being on the Ohio river.

The estimate made above of the cost of roads built in the year 1904 indicates that roads now cost more than formerly, which is largely because better methods of construction are used, and the general estimates of the present general average costs of gravel and broken stone roads, made in the article in the August number, are justified, as well as the figure of $2,000 per mile as an approximation to the average cost of good roads built in modern style in the state.

LAWS GOVERNING INDIANA BRIDGE LETTINGS.

Where can I get a list of the members of the Indiana Engineering Society, and where can I obtain a copy of the laws governing the letting of bridge contracts in the state of Indiana?

W. J. W.,
Cleveland, O.

The last volume of proceedings of

the Indiana Engineering Society contains the list of members and can be furnished for 50 cents.

The report of the Indiana State Geologist for 1905 is devoted almost entirely to road materials and in the appendix will be found the laws governing road construction and bridges. If a copy cannot be secured on application to the State Geologist, doubtless one can be consulted at the Case Library in Cleveland.

TROUBLE WITH STEAM HEATING SYSTEM.

Will you kindly advise through the columns of your valuable magazine as to the cause and theory of the water leaving a sectional boiler when firing same? And also the route that the water takes to leave the boiler—whether through the steam line, or the condensation line, and can you suggest a remedy? SUBSCRIBER,
Newcastle, Pa.

Mr. C. A. Tripp, of Indianapolis, an expert upon such problems, suggests several possible reasons for the difficulty described. His first suggestion is that the water may not have been changed recently and the trouble may be due in part at least to priming. It may in part or wholly be due to obstructions in the steam line or traps which retard the flow of the steam, so that when certain radiators are opened the least resistance is from the condensation line so that the steam pressure in the boiler forces the water back through the condensation line before the steam itself can fill the radiator. Partial vacuum somewhere on the line due to traps would aid in such action. It is quite possible that the volume of steam required to fill all the pipes and radiators is such as to lower the water line in the boiler unduly and require replenishing until the system is in working order. The water space in such case would be too small in proportion to the space in the system to be filled with steam. There are still other causes for the trouble, due to defects in design, construction or maintenance, and the exact cause could only be determined by an inspection of the system. Perhaps some of our readers can suggest reasons for the difficulty, derived from their experience.

The above was sent to our correspondent, who sent the following reply:

I am in receipt of your favor containing Mr. Tripp's remarks regarding the difficulty we are having with our sectional boiler. In addition to my former letter I will say, the boiler is perfectly primed and contains plenty of water to supply the system, and under uniform firing works all right. The trouble occurs when an attempt is made to suddenly force the steam pressure by hard firing. The water in that case usually takes a sudden drop, sometimes below the water gauge, but in a short time will return. There is plenty of water space in the boiler, and there are no obstructions, nor traps in the steam line.

I am told that this trouble is a very common one in other boilers. Some engneers claim that the water in such cases leaves the boiler by way of the steam line—as saturated steam. I can scarcely bring myself to see the force of this theory. My idea is that the suddenly generated steam forces the water back through the condensation line. If this should be the trouble would a connection between the steam chest (or the space in the boiler above the water line) and the condensation pipe—connecting it at a point above the water line—obviate the trouble? I cannot see, in that case, how the water could be forced back through the condensation line, as the steam pressure would be approximately equal on both water columns, and one could not rise higher than the other. It has been suggested that a check valve placed in the condensation pipe near its foot might stop the trouble. Would you recommend either of these methods, and which would likely be the better?
SUBSCRIBER.

Mr. Tripp's suggestion in the light of this more definite information is that if the water line in the return pipe can be 12 inches above the water line in the boiler without flooding radiators, a check valve can be put on the return near the boiler and will prevent the back flow of water with the sudden increase in steam pressure. The difficulty may occur because the steam pipes are too small and the steam space in the boiler is too small. If the main steam line is large enough an equalizer pipe as described, entering the return above the water line, will help. Not enough detail of size of pipe, size of system, method of laying out, etc., is given to warrant a definite statement of the trouble. Each steam heating system is individual in its idiosyncrasies and requires individual treatment and general rules may fail if applied too strictly in any one case.

IMPERVIOUS CONCRETE.

I have in mind for a thesis subject "Reinforced Concrete Under Hydraulic Pressure." The thesis is to be prepared for senior college work. Can you tell me whether or not this subject has ever been taken up experimentally? Also can you inform me if there are many concrete structures now in existence such as standpipes holding high heads of water? I have been at work the past year on a pressure pipe for government irrigation purposes that is

designed to hold a head of 50 feet. In some cases where the concrete can be covered with earth absolute imperviousness is not necessary, but in others such as water towers there must be no leakage. I could do considerable experimenting for imperviousness and would probably subject to pressure cylinders of reinforced concrete varying the proportions of cement, sand and gravel, the consistency, the thickness of the walls and manner of making joints. At least I want to determine these things if I cannot get the literature of some fellow who has.

W. A. B., Ames, Iowa.

Regarding concrete conduits, perhaps the most valuable paper is by John H. Quinton, of the U. S. Geological Survey, entitled "Experiments on Steel Concrete Pipes on a Working Scale," which is published as "Water Supply and Irrigation Paper No. 143" of the Survey. The final conclusions and suggestions of methods of building such conduits and making them impervious will be found in MUNICIPAL ENGINEERING, vol. xxix, p. 353. A description of the Newark, N. J., 60-inch double reinforced conduit is given in vol. xxv, p. 364, and in vol. xxxi, pp. 167 and 182, will be found a description of the method of manufacture and use of reinforced concrete pipe and the results of tests under water pressure.

Chester Wason Smith will present to the American Society of Civil Engineers on October 2 a paper on the Pinto Creek, Arizona, reinforced concrete pipe for carrying water under pressure, which is a feature of the Salt River project of the U. S. Reclamation Service. The method of construction is given and the results of tests of leakage are described and tabulated. Comparison is made with Mr. Quinton's paper and reasons for differences are assigned. This paper is printed in the August number of the Proceedings of the American Society of Civil Engineers and will appear elsewhere after it has been presented to the society.

A paper on "The Laws of Proportioning Concrete" was presented to the same society on April 17, 1907, by William B. Fuller and Sanford E. Thompson, in which they describe their method of making tests of permeability of concrete and give the results of a considerable number of experiments upon prisms made of various aggregates and materials. This paper was published in the Proceedings of the American Society of Civil Engineers for March, 1907. It may be taken as an excellent instructor in the methods of making such tests.

The use of waterproofing compounds for making concrete impervious is discussed in MUNICIPAL ENGINEERING, vol. cussedinncretep-,Vol.Sono to co T r, xxxii, pp. 164, 165, 204, 343, 393, 411. Names of makers of various waterproofing compounds are given in vol. xxxi, pp. 402, 459, 482.

Books treating the subject are the "Handbook for Cement Users" ($3); Buel and Hill's "Reinforced Concrete" ($5), which refers to Feret's, Hyde and Smith's and McIntyre and True's experiments on methods of decreasing permeability of concrete; Taylor and Thompson's "Concrete; Plain and Reinforced" ($5), which gives reference to a dozen sources of information about tests of permeability and porosity of cement, as well as describing the authors' method of making tests, and their methods of proportioning concrete to make it impervious, as well as other methods of waterproofing concrete surfaces; Sabin's "Cement and Concrete" ($5), which gives a briefer discussion on about the same lines.

A concrete standpipe is described in MUNICIPAL ENGINEERING, vol. xxvi, pp. 162 and 428, and others are described in the books above referred to. Other articles on the subject will be found in vol. xxvi, pp. 167 and 352 and in vol. xxv, pp. 374 and 445.

CEMENT POST PROBLEMS.

I desire information relative to cement posts and post machines as follows:

1. What is the best mixture for making cement posts?
2. What is the adhesive power of iron to cement?
3. Of wood to cement?
4. What effect has cement on iron imbedded in it?
5. What effect on wood?
6. With a core of wood will cement shrink away from the wood?
7. What is the best material for reinforcing a post?
8. Is hoop iron better than wire?
9. Is crimped wire of any advantage?
10. Is anything gained by binding the ends of the wire over to make it hold?
11. Do cement posts set in the ground deteriorate, crumble or scale, especially at the surface of the ground?
12. Has a good, serviceable cement been produced as yet?
13. What can you say as to the different methods of fastening the fence to the cement posts?
14. Do wires fastened to or imbedded in cement posts for this purpose rust off quickly?
15. What is the best method of fastening fence to cement posts?
16. Is there a good, practical fence post machine on the market at a moderate price?
17. Do you think cement posts practical at the present time?

18. What is the price of your Cement Hand Book?

19. In making concrete posts which is preferable, wet or dry mixture? How wet? How dry?

J. F. E., Mendon, Mich.

1. The exact proportions of materials depend upon their character and the voids in the mass. Good gravel or broken stone with sand are used with success. The stones must not be too large. None should be larger than one inch in largest dimension and few should be more than one-half inch. Sand enough should be used to fill all the voids in the gravel or stone and cement enough should be used to fill all the voids in the sand. These requirements will make the proportions of cement, sand and stone say 1:2½:5 or 1:3:6, the exact proportions to be determined by trial with the materials to be used. Clean, sharp sand should be used and crushed gravel will be better than the rounded gravel of the ordinary pit or stream. There should be no loam or clay in either sand or gravel, although some quite satisfactory results have been obtained when there was fine clay in the gravel in amount not to exceed 3 per cent.

2. Numerous tests have been made of the adhesion of cement and concrete, which vary according to conditions of test, results running from about 100 pounds per square inch in sand mortar to 580 pounds a square inch in concrete of 1 part cement, 2 parts sand and 4 parts broken stone, the tests being made by pulling out rods imbedded in concrete. Most of the tests made with materials such as those described in (1) give results of 400 to 500 pounds or more.

3. But little has been done in testing the adhesion of wood and cement. They are ordinarily not very strongly adhesive, but if tested by pulling wooden rods out of concrete in which they are imbedded, quite high results might be obtained under some circumstances and low results in others, according to the condition of the wood, which is further considered in some of the following answers.

4. If the mortar or concrete is moist enough when applied, the neat cement will cover the steel or iron with an exceedingly thin coat, which serves as a preservative and prevents the oxidation of the steel, except, possibly, in case of an electric current producing electrolysis where it leaves the steel. Cement or concrete itself has no particular effect upon wood.

6. Water from the concrete, which must be wet when it is deposited, will be absorbed by the wood, unless it is waterproofed. The wood will swell and then in drying out again will shrink and may pull away from the concrete or split. The shrinkage of the concrete would not be great enough to compare with this shrinkage of the wood.

7. Some form of iron or steel is probably best, all things considered, for reinforcing concrete posts.

8. The form to be used depends on the design of the post, the location of the metal in the post and the strength required of it. Plenty of strength can be obtained from wire and possibly its adhesion to the concrete may be greater than that of hoop iron. Properly used there can be no objection to either form of reinforcement.

9. No particular advantage in the use of crimped wire in a post occurs to the writer, except that it may happen that the metal is better distributed to resist shear.

10. There is some difference of opinion on this point, but, except when the bent-over end happens to aid in resisting shear, no particular advantage of the bent-over ends in a post appears.

11. Posts which dry out too soon, so that the cement does not fully set, will gradually crumble and scale as far in as the cement has not had water enough to complete its chemical action. Posts which are made with a mixture poor in cement, i. e., whose voids are not completely filled, will absorb water and frost may cause them to crumble and scale. This action would be most noticeable near the surface of the ground, especially if the ground is wet. The remedies are the use of enough cement and thorough curing, using enough water during the process.

12. There are many good serviceable cements on the market. They differ somewhat in their qualities and it is now possible to select a first class Portland cement for the legitimate special needs and preferences of each user.

13. A fence post fastener should be strong, durable, easily applied, not easily removed except by design. There are many kinds on the market of all designs, good, bad and indifferent, some of which are described in general below.

14. Galvanized wires should not rust easily and will not until the protection is broken through, when they rust rapidly. Much manipulation of the wires in bending and twisting

breaks the coating and opens the way to rust.

15. The writer prefers a fastening consisting of a collar of rustless metal imbedded in the post, into which a wire or other form of metal spring is slipped, the fence wire being encircled by an eye in the fastener. There are several forms on the market which answer this general description. Holes entirely through the post allow ordinary wire to be used for fasteners, which are easily removed and replaced. Notches in the corners of the post can be used to hold ordinary wire bands in place to which the fence wires are attached.

16. There are many good post machines and molds on the market. The principal requirements are good form, strong sides, ready method of removal. Many machines base their claims on rapidity of operation, but excellence of product should be the first aim. Good posts cannot be made very rapidly, nor can the molds be removed at once from posts made with a mixture of the right consistency to produce the best results. Reference may be made to the "Business Directory" printed in each number of MUNICIPAL ENGINEERING for names of makers of good post machinery, under the headings "Cement Posts" and "Concrete Construction Machinery."

17. Cement posts properly designed, properly constructed of good materials and properly cured and handled are certainly practical. They are made every day and are in successful use. They will cost more than wooden posts to make and set, but for a permanent fence they will be most economical in the end except where wooden posts are very plentiful and of low cost for good material.

18. The price of the "Handbook for Cement Users" is $3. It contains much of great value to one wishing to make good concrete and gives methods of construction and specifications for work in which concrete is used as well as full specifications for securing good cement and other materials.

19. The mixture should be as wet as possible. If it is too wet the mold can not be removed until the concrete has set. The mixture should be just dry enough to permit prompt removal of mold, and this consistency can only be determined by trial. It will take more or less water according to dryness of sand, moisture in the atmosphere, etc., so that the exact condition of the mixture must be determined largely by its appearance and it therefore takes some experience to become expert in making the best posts possible at the most rapid rate possible for the best results.

Some of the above questions are subjects of considerable discussion and our readers are invited to express their opinions if they differ from those above stated.

FROM WORKERS IN THE FIELD.

PRACTICAL POINTS FROM PRACTICAL PEOPLE.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know, use this Department for what you can tell others.

COST OF PUMPING WATER.

With reference to the cost of pumping water in small plants the following data are reported regarding cost of pumping by the air lift, names of plants not being mentioned: In a plant of 4,000,000 gallons daily capacity, $6.67 per million gallons 100 feet high; in a larger plant $4.28; in a plant one-third the capacity, $13.33; in one three-fourths the capacity, $60.00 or $70.00 per million gallons 100 feet high with lift of 75 and 50 feet respectively. In a very small plant $17.77. Most of these are observed costs. Estimates for other plants show $2.00 for a 100,000,000 gallon plant, $8.33 for a 15,000,000 gallon plant and $14.76 for a 1,500,000 gallon plant. The actual lifts in the last three estimates were 50 feet, 30 feet and 75 feet respectively, but the cost has been reduced by proportion to 100 feet of 1,000,000 gallons. Cost of coal was given in each case at $2 a ton with one exception (the lowest cost estimate given), where it was $1.50 a ton.

From a comparison of various fuels for running a 50 horse-power engine, which would pump about 8,000,000 gallons 100 feet high per horse power per year, working week days, the cost of pumping water by steam power under the assumed conditions was estimated

at $9.71 for 1,000,000 gallons 100 feet high; by city gas, $9.43; gasoline, $8.36; electric motor, $6.56; anthracite producer gas, $3.28; coke producer gas, $2.85 per million gallons 100 feet high. Costs of the different fuels in the city for which the estimates were made are not stated.

ELECTROLYTIC CORROSION OF IRON AND STEEL IN REINFORCED CONCRETE.

In a paper presented to the American Institute of Electrical Engineers, Mr. A. A. Knudsen gives the results of some experiments which he has made and which he thinks have proven that electrolysis will affect steel imbedded in concrete, wherever the electric current leaves the steel, and that the disintegration of the concrete in the vicinity follows as one of the consequences. His conclusions regarding the protection of steel from corrosion and of concrete from disintegration are stated as follows:

Coatings of various kinds of paint or varnishes will be of little use as an insulation, for it must be borne in mind that not only a moisture resistant is required, but an insulation that will resist continual moisture, and also that will stand the pressure of great weight. From laboratory experiments as well as observations in practice, we draw the following conclusions:

1. Steel structures are well preserved from ordinary corrosion by concrete if placed either in salt or fresh water. This, however, has long been known.
2. If but a small fraction of an ampere of electricity passes from an interior metallic column or structure into concrete or masonry as usually made, there will be corrosion of the metal and disintegration to the concrete masonry.
3. Structures of steel in concrete that are subject to sea water are in more danger from electrolytic action than those in fresh water, by reason of the lower resistance of concrete in the sea water as shown by the laboratory experiments.
4. In no sense can concrete be considered an insulator, and it is from all appearances just as good an electrolyte as any of the soils found in the earth.

ILLUMINATION PHOTOMETERS.

Regarding apparatus for measuring the intensity of illumination, a paper by Preston S. Millar before the Illuminating Engineering Society describes the principal forms of illumination photometers and sums up their characteristics in tabular form for comparison, with the following general results:

The Beckstein photometer, sector type, is a European machine of high sensibility, using an electric lamp and a sectored disk. The test plate may be set at any angle, the color is white, the view point and location with reference to instrument parts are correct.

The Beckstein instrument, Weber type, is the same except that a benzine lamp is used and the variation in setting is produced by varying the distance.

The Blondel and Broca instrument is European, has low sensibility and uses diaphragms to produce the variations in light. Test plate details are the same as above.

The Burnett photometer is an American instrument of low sensibility, using an electric lamp with variations in distance. The test plate may be placed at any angle, is white, and the view point and location with reference to instrument parts are considered incorrect. It is used by the substitution method.

The Marshall instrument is also American of low sensibility, using an electric lamp which is varied in intensity by varying the current. The test plate is placed horizontally, the color is pinkish white, the view point is incorrect and the location with reference to instrument parts is correct. Direct comparisons are made.

The Martens is European, of high sensibility and uses a benzine lamp whose distance is varied. The test plate is placed horizontally, the color is white, and the view point and the location with reference to instrument parts are said to be incorrect.

The modified Mescart is a European instrument of low sensibility, using diaphragms to produce variations in light. The test plate may be placed at any angle, the color is white and the view point and the location are correct. The substitution method is used.

The Preese-Trotter is a European instrument of low sensibility, using an amyl-acetate lamp and an inclined surface to produce variations in light. The test plate is placed horizontally, the color used is white, the view point is incorrect and the location with reference to the instrument parts is correct.

Ryan's is an American instrument of low sensibility, using an electric lamp whose distance is varied. The test plate may be placed horizontally or vertically, the color is white, the view point is incorrect and the location of the plate with reference to instrument parts is correct.

The Weber instruments are Euro-

pean and are of high sensibility. One of them uses a benzine lamp, the portable machine using an amyl-acetate lamp. Both make variations in light by changing the distances. The test plates can be placed at any angle, the color is white, the view points and the locations of plates are incorrect. The direct comparison method is used.

Before the same society Dr. Chas. H. Williams described a new photometer using the comparison method, using an electric lamp and varying the intensity by varying the angle of a refracting prsm. A difficulty is found in differences of color of daylight or other sources of light and the artificial standard light on the ground glass of the surface where the comparison is made.

ROADS AND PAVEMENTS

Chicago Paving Repairs — Rocks for Road Building — Macadam for Paving — Cinders for Sidewalks — Asphalt Production — Bridge Contract Valid.

Paving Repairs in Chicago.

The Chicago city council has passed an ordinance authorizing the Board of Local Improvements to repair all pavements, including curbs and gutters, where the contracts for the original construction contain a provision by which the contractors warrant such pavement to last a period of years and covenant to repair during the time limited. The Board is further authorized to advertise for bids and to let contracts to the lowest responsible bidder.

Original contracts for paving generally contain a clause warranting the pavement for ten years and covenanting to repair it during that time if necessary. Difficulty has been experienced in getting some of the contractors to carry out their warranty notwithstanding the fact that bonds have been required in each case to guarantee the fulfillment of the contract.

The intention of this ordinance is not to relieve the contractor or his surety from his obligation, but it is for the purpose of enabling the Board of Local Improvements to make repairs preparatory to compelling the contractor and his surety to pay for them. It has been found difficult to prove damages in a suit against the contractor and his surety for breach of the warranty before the amount of damages for such breach has been fixed by the actual performance of the repair work required.

The Board has advertised for bids in connection with the following contracts where repairs have not been made as required:

Twenty-one contracts of Joseph J. Duffy & Co. upon which the warranty still has from three to seven years to run. The estimated cost of these repairs is $6,150. The surety on nineteen of these contracts is the National Surety Company; on one the United States Fidelity & Guaranty Company, and on one the City Trust and Savings Deposit and Surety Company of Philadelphia.

Twelve contracts of Charles J. Kelly under which the warranty has from two to three years to run. The estimated cost of the repairs is $20,975. The surety on three of the contracts is the National Surety Company; on seven the American Bonding & Trust Company of Baltimore; on one the United States Fidelity & Guaranty Company, and on one A. J. Sabath and John E. Fitzgerald.

Five contracts of C. M. Netterstrom where the warranty has from two to five years to run. The estimated cost is $1,750. The National Surety Company is on three of the contracts and the United States Fidelity & Guaranty Company on two.

Six contracts of John P. Agnew & Co. with warranties having from three to four years to run. The cost of repairs is estimated at $12,100. The National Surety Company is surety on all of the contracts.

Two contracts of A. G. Pugh with warranty having still five years to run. Estimated cost, $300. Private in-

dividuals went on Mr. Pugh's contract.

Two contracts of Bermudez Asphalt Paving Company with warranty having from three to four years to run. The National Surety Company is on both contracts. The cost of the repairs is etimated at $3,000.

Rocks for Road Building.

The office of public roads of the U. S. Department of Agriculture has issued a bulletin by Edwin C. E. Lord on the examination and classification of rocks for road building, including a brief statement of the physical properties of rocks with reference to their mineral composition and structure. The methods of analysis by examination with the unaided eye and with the microscope are given briefly and the various rocks which can be used more or less successfully for road building are classified as igneous, sedimentary and metamorphic. The igneous rocks are the primary forms. The sedimentary rocks are the result of breaking down and redepositing the primary rocks, with additional materials, such as shells, for example. The metamorphic rocks have been changed after deposition, by the action of heat, pressure, moisture, etc.

The minerals found in these various classes of rocks are listed and a table shows the percentage of each found in the ordinary rocks available for road making. The effect of the decomposition of the primary rocks in making them better road materials is discussed, also the character of the sedimentary rocks and the probable effect of the conditions producing the metamorphic rocks.

Some attempt is made at correlating the physical properties of rocks with their mineral composition, particularly with reference to their application to road materials, and the following general conclusions are drawn:

(1) Igneous and metamorphic rocks, owing to a higher degree of crystalligation and a preponderance of silicate minerals, offer a greater resistance to abrasion than nearly all varieties of sedimentary rocks.

(2) The coarse-grained intrusive rocks of the igneous class are harder, but break more readily under impact than the finer-grained volcanic varieties of like mineral composition.

(3) The delecterious effect of atmospheric weathering on the wearing qualities of rocks has been demonstrated.

(4) The cementing value of rocks is, to a certain degree, measured by the abundance of secondary minerals resulting from rock decay.

(5) Metamorphic rocks have, as a rule, a low binding power, owing to a regeneration of secondary minerals and to the effects of heat and pressure. The foliated types part readily along planes of schistosity, and therefore are not well adapted to road construction.

(6) The quantitative mineral analysis of rocks serves to a certain extent as a measure of their useful properties for road construction.

A City Engineer's Judgmeat of Macadam for Street Paving.

A report submitted to Mayor James C. Cutler, of Rochester, N. Y., by City Engineer Edwin A. Fisher is not favorable to macadam pavement. According to authorities quoted in the report the cost of maintaining macadam is much greater than that of maintaining asphalt, brick or block pavements. In his report Mr. Fisher quotes from Samuel Whinery's lecture before the civil engineering students of Cornell University in 1900, in which he produced a table showing the cost of the construction and maintenance of pavements on a street having a traffic of 100 tons per square yard per day. This tonnage would, it was explained, correspond to that on a rather heavily traveled residence street or a business street of medium travel in cities from 100,000 to 200,000 population. The tables is as follows:

Material.	Life of pavement.	Annual cost.
Granite block	20 years	$.402
Sheet asphalt	15 years	.297
Brick	12 years	.290
Macadam	5 years	.512

Mr. Fisher investigated the construction of the macadam pavement on Commonwealth Avenue in Boston, which was laid in 1894. The pavement cost $1.80 a square yard. In his report Mr. Fisher quotes C. E. Putnam, engineer of the Board of Park Commissioners of Boston, who supervised its construction, as follows:

The original cost was very high and the maintenance is very high, the average cost of maintaining of the last three years being $.271 per square yard, not including the area of the gutters, and $.223 per square yard if the area of gutters is included, while at the same time the average cost of maintenance of all of our park roads has been $.116 per square yard, not including area of gutters, and $.096 including area of gutters.

Mr. Fisher's report indicates that on a heavy traveled residential street the life of a macadam pavement is much shorter and the annual expense of maintaining it much greater than in the case of asphalt or brick. The original cost of a macadam pavement in Rochester has in some instances, it is

claimed, been nearly if not quite as great as that of asphalt. Constant care is necessary to keep the macadam road from wearing out. The best engineering practice for country roads is said to be to employ a man steadily for each limited section of road, to spend his entire time in filling depressions with screenings and in preventing ruts from forming. Macadam roads in Onondoga county in the past have been ruined and rendered worse than the average dirt road by failure to adopt such systematic precautions. Macadam within the city limits deteriorated too, within six months. Asphalt or brick pavements were substituted because for streets of this character a hard surface with a solid concrete foundation is absolutely essential. In constructing a pavement it is not alone necessary to look out for a proper surface, but also to provide for a foundation.

The Production of Asphalt and Bituminous Rock in 1906.

The total production of asphalt in the United States in 1906 amounted to 138,059 short tons, valued at $1,290,340, as against 115,265 short tons, valued at $758,153, in 1905, an increase in 1906 of 20 per cent. in quantity and of 70 per cent. in value.

The term asphalt is here used in its broader sense and is made to include all varieties, natural and refined, liquid, semi-liquid, and solid, from the almost pure bitumen, or oil asphalt, to the bituminous sandstones and limestones. The production of these varieties in 1906 is shown in the following table:

Production of asphalt in 1906, in short tons.

	Quality.	Value.
Bituminous sandstone.	24,085	$ 70,686
Mastic	2,543	24,158
Hard and refined, or gum	24,178	341,106
Liquid or maltha	9,900	86,750
Wurtzilite—Gilsonite	12,947	159,960
Grahamite	1,952	16,432
Oil asphalt	62,454	591,248
	138,059	$1,290,340

The great increase in the production of hard and refined (or gum) asphalt in 1906 over that of 1905, which amounted to only 3036 short tons, is due chiefly to the new refinery development in Texas, although the production of this variety in California in 1906 (8178 short tons) is 100 per cent. in advance of the total for 1905.

In the production of oil asphalt California stands almost alone, producing 62,361 short tons of the total quantity and showing a substantial increase over the production for 1905. A very small output is reported from Texas.

An advance chapter from "Mineral Resources of the United States, Calendar Year 1906," on the production of asphalt and bituminous rock in 1906, prepared for the United States Geological Survey by Joseph A. Taff, geologist, will soon be ready for distribution, and copies may be obtained without charge by applying to the Director of the Survey at Washington, D. C. The report treats briefly of the occurrence and uses of the material and gives the statistics of production, export, and import.

Why not use Cinders for Sidewalk Foundation?

Bay City, Michigan, has just gone through a spirited discussion as to who gave contractors permission to use cinders under sidewalks. City Engineer Thompson says that investigation on his part brought out from a contractor the information that he was using cinders under the instructions of the chairman of board of public works. The mayor disclaims any knowledge whatever regarding the matter, and says that no one ever asked for the privilege of using cinders. It has been suggested that the contract system be cut out and that the city build the walks.

Nebraska Bridge Contract Invalid But Contractor Can Be Paid.

In a decision handed down at Lincoln, Nebraska, August 26, by Judge T. C. Munger in the suit of John H. Sparks vs. Gage County wherein he seeks payment for some bridges alleged to have been constructed by him in that county for which he had not been paid, Judge Munger held that both contracts under which he had built the bridges and repaired others were invalid and that the amount sued for could not be secured on the contract. The ruling, however, did not preclude the contractor receiving for his labor on the ground of a just and reasonable recompense for labor and material used. On the second cause of the petition of the plaintiff the judgment was prayed for on two grounds—that of the contract, and that of a reasonable recompense for labor and material used. The decision held, on this cause of suit, that a reasonable recompense was due the plaintiff even though the contract was invalid.

The case was a doubtful one in char-

acter, in which John H. Sparks, of St. Joseph, Mo., entered into contract with the county commissioners of Gage county to build some bridges and repair others. He did the work and it was accepted by the commissioners, in 1904. Payment was protested later on the grounds that the contract was invalid and that the work was not done as per contract. Suit was brought in the district court to resist payment, and Sparks retaliated by entering suit in the federal court to compel payment of the amount due. He asked judgment on two counts. First, for the new bridges he had constructed. He had contracted with the commissioners to build the bridges and the work had been accepted by them. He argued that he knew there was no bridge money in the treasury but that the contract had been made so that it was to take effect after the annual tax levy of 1904. He had not filed his $5,000 bond until after the levy had been made on that account, nor had he begun work. He asked judgment on this cause of $4,413.06. Second, he asked for judgment of $7,037.23 for repaired bridges both on the same kind of contract as the other and because plaintiff had spent a certain amount of labor and material on the task. It was because of this latter clause that the decision was to the effect that payment was to be made.

The demurrer filed by Gage county against the petitions of Sparks in the federal court says the contract is invalid because there was no money in the bridge fund, and so was contrary to the statute which declares that no contracts shall be entered into for the construction of bridges costing over $100 when there is not money enough in the treasury from the previous year's levy and from two-thirds of the current year's levy for their construction. The court found that the levy was not known at the time the contract was entered into, and that the bond being signed after the levy had been made did not affect the case. In the second cause the contract was not let after due advertisement for bids, and so was invalid, but after the board had accepted the work reasonable recompense was collectible if the suit was brought on that ground.

DRAINAGE AND REFUSE

Reclamation of Newark Meadows — Street Cleaning in Washington — New Jersey Stream Pollution — Chicago Drainage Board Plans— Rochester Sewage Discharge—Sea Beach Pollution.

Reclamation of Newark Meadows.

The national government and the cities of Newark and Elizabeth, N. J., have entered into an agreement which contemplates the reclamation of the Newark Meadows, a strip of salt marsh containing practically 10,000 acres and lying directly between the two cities interested. The cities need the land not only for truck gardening but for building space, and the government is anxious to establish a standing example of the possibilities of developing swamp lands. The situation of the Newark meadow reclamation is such as to make it easily accessible to millions of people who might profit by its teachings and be induced thereby to undertake the drainage and improvement of other vast tracts by private enterprise.

Newark and Elizabeth have asked authority of the state to issue bonds to pay for the work. The granting of the authority is a formality, and the plans are going forward in the meantime. As soon as the legislative permission is given, the Department of Agriculture will enter into a definite contract, agreeing to do certain things in the way of providing plans, surveys and supervision, while the cities on their part agree to carry forward the actual work.

Cost of Street Cleaning in Washington.

In his annual estimates for the next fiscal year, to begin July 1, 1908, by

John T. Twohey, superintendent of street cleaning for the District of Columbia, submitted to the District Commissioners September 13, he asks for an appropriation of $500,840, which sum is an increase of $43,480 over the amount appropriated for this branch of the local government for the present fiscal year. Of this total amount $45,500 is to be devoted to salaries, an increase of $480; $27,000 is for street cleaning, an increase of $37,000; $168,340 for collection of garbage, refuse and ashes, for which the same was appropriated for this year, and $10,000 for removal of snow and ice, which is an increase of $6,000.

Regarding the appropriation for the street cleaning department Superintendent Twohey is of the opinion that by the strictest economy and the closest figuring he will need at least $277,000 next year. He bases this increase upon the possibility of the limitation placed by Congress upon the amount to pay for street cleaning—19 cents per 1,000 square yards—being increased at the next session of Congres to 22 cents per 1,000 square yards. He is also meeting with difficulty in securing satisfactory and available dumps in connection with this work. He also says:

In May last another dump was closed to us, leaving but six under our jurisdiction and it is more than likely that two of those, the only ones located in the northwest section of the city, will have to be closed during the current year, as they are being filled up very rapidly. When this takes place all of the hand sweepings west of Seventh street northwest will have to be hauled distances of 2¾ and 3¾ miles. In order not to exceed the 19 cent limitation of cost for hand cleaning it is necessary to assign to each laborer on that class of work an average of about 10,000 square yards of pavement. This area is altogether too much for one man to keep clean, and it is, therefore, desired to reduce the surface yardage per laborer by about 1,000 square yards.

For the foregoing reasons it is necessary that the limitation in cost be increased from 19 cents per 1,000 square yards.

The following is a detailed statement of the estimated expenditures for street cleaning work for the fiscal year 1909, and explains the increase of $37,000 asked for:

Hand cleaning, 500,000,000 square yards at 20½ cents per 1,000, $102,500; machine cleaning, 430,000,000 square yards at 22¾ cents per 1,000, $97,825; unimproved street cleaning, 280 days at $73.80 per day, $20,684; alley cleaning, 90,000,000 yards at 40 cents per 1,000, $36,000; sprinkling streets, $12,500; incidental expenses, $7,000; total, $276,500.

As will be seen, the estimated expenditure for hand cleaning is based upon a cost of 20½ cents per 1,000 square yards.

In September, 1906, the machine sweeping schedules were rearranged so that streets which had theretofore been cleaned once and twice per week, respectively, were scheduled for three sweepings per week, and the area for daily sweeping was also increased by the addition of some of the main thoroughfares that had previously been cleaned three times per week. By reason of these changes the schedules were increased about 500,000 square yards per day, and the streets swept 6 times and 3 times per week, respectively, instead of 6 times, 3 times, 2 times and once per week, respectively, as under the old arrangement.

The item for unimproved street cleaning is based upon the contract price per day and the number of days upon which it is estimated that work will be performed.

Prior to November, 1906, all public alleys were cleaned but once per week. In that month the alleys in the business section of the city bounded by Fifteenth street west and First treet east, Florida avenue and the Mall were added to the schedule for a second cleaning each week, and that arrangement has been continued ever since. The results have been so gratifying from a sanitary standpoint that it is proposed to clean all of the public alleys twice per week; hence the estimated expenditure of $36,000 for that class of work.

For cleaning snow and ice from cross sidewalks and gutters, under the act approved March 2, 1895, the sum of $4,000 was allowed the street cleaning department for the present fiscal year, but experience has taught Mr. Twohey that this sum is far too inadequate and that at least $10,000 will be necessary. He says an ample fund should be at all time available and Congress should not have to be called upon when extra funds are necessary, as has been the case several years in the past. The past two winters were exceptionally mild and the strictest economy was practiced, yet the $4,000 proved to be too small.

No increase is asked for in the collection and disposal of garbage, dead animals, miscellaneous refuse and ashes and the collection of night soil. The sum of $168,340, which was appropriated for this year, will be sufficient for next year, he says.

New Jersey Municipalities Move Slowly in Matter of Stream Pollution.

At a meeting of the pollution committee of the Board of Trade, at Newark, N. J., September 4, called for the purpose of trying to ascertain what could be done by way of hastening measures for the cure of river conditions, the Passaic Valley District Sewerage and Drainage

Commission was criticised and censured by all who spoke with one exception. The chairman of the committee, George W. Tomkins, in opening the meeting said that relief cannot be afforded too quickly, and that nearly seven months had already passed since the new act was passed, yet nothing had apparently been done to bring it to fruition. Former city counsel Coult defended the commission, expressing it as his opinion that the commission had done all that was possible, and that blame for whatever delay there has been should be put on the several committees that have been apathetic in the matter.

For and Against Chicago Drainage Board Plans.

In a report of the sanitary district committee of the real estate board of Chicago September 4, a letter from John W. Alvord, sanitary and hydraulic engineer, was included in which he criticised the sanitary district for committing Chicago to a purely business enterprise in the proposed extension of the ship channel through Joliet. He also attacked the Calumet-Sag channel, and made the statement in answer to the talk about the sewage of the Calumet river polluting the drinking water supply of Hyde Park, that the official records of the Chicago health department show that the water received through the Sixty-eighth street intake for the last five years has not in a single instance been contaminated by sewage from the source indicated. He declared that there can be no doubt that the state of Illinois or the sanitary district can effectually stop the state of Indiana from emptying its sewage into Lake Michigan in such a way as seriously to contaminate the water supply of Chicago. Also, that as the result of the efforts of Chicago to develop the Calumet river at the expense of the Chicago river with the idea that they were both parts of Chicago, and, therefore, there was no rivalry between them, this port, counting in the commerce of the two rivers, has absolutely lost ground as compared with 1889, while Milwaukee and Duluth particularly have made large gains, the former over 50 per cent. since 1893, while Duluth has jumped from 3,000,000 tons in 1890 to 22,000,000 in 1905.

He criticised the cost of the proposed dilution method of disposing of the sewage in the Calumet district as compared with the biological method, and declares that a careful report by competent authority, removed from local prejudice, would be welcome by taxpayers, and declared that the board is not keeping abreast with the revolutionary changes made during the last five years in disposing of sewage, and that, instead, their attention seems to be centered upon commerce and water power.

A complete analysis of the drainage and sewerage question in the Calumet district is to be made by Rudolph Hering, of New York City, for the board of trustees of the sanitary district. He expects to present his report early in October. In a report to the International waterways commission ten months ago Mr. Hering enumerated four ways in which the sewage of the Calumet region might be disposed of, as follows:

1. A canal reversing the flow of the Calumet river and connecting with the drainage canal through the Sag near Lemont.
2. Sprinkling filters.
3. Intermittent sand filters.
4. Contact filters.

In his international waterways report Mr. Hering declares for the canal as the best method of getting rid of the sewage. In addition he says:

Without considering the canal project, the best of the other three methods is the sprinkling filter system. It is new. It has never been used in the United States, though it has been tried successfully in England for six or eight years. Installation of such a system of sufficient magnitude to purify the sewage of the Calumet district would cost $18,000,000. The sewage would be received in a settling basin of eighty acres filled with crushed stone and studded with fountains fifteen feet apart. These fountains would throw the sewage into the air so that it would shower down upon the crushed stone in drops and be oxidized as it precolated through. This oxidization would give it an adequate degree of purification. It might then pass into the lake without danger of contaminating the water supply.

In the contact filter system the sewage rises from the bottom through crushed stone. In the intermittent filter system the sewage is let upon sand in trenches. When it percolates through the sand into the river it is practically pure water. This system for the Calumet district would require 1,200 acres of sand. It is the most thorough and the most expensive of the three systems.

Rochester Proposes to Discharge Sewage Into Lake Ontario.

An exhaustive report on the question of sewage disposal has been made to the city officials of Rochester, N. Y., by the civil engineers who have been

investigating the whole matter. They discuss the various plans that have been suggested, and conclude with a recommendation that a conduit of masonry 4.36 miles in length and from five to seven feet in diameter should be constructed from the intersection of Strong and Hollenbeck streets to a point a mile and a half east of Summerville, to carry the sewage from the city to the shore of the lake and that it should then be carried in a five-foot iron pipe at least 7,000 feet from shore where the water is forty-five feet in depth, in order that thorough sedimentation of the suspended matter and diffusion of the dissolved matter may take place. The report was prepared by Emil Kuichling, C. E., with the approval of members of his profession, who think the above plan is the best suggested. The engineers have examined six different plans, as follows:

1. Constant dilution by means of a storage reservoir at Portage or Mt. Morris.' Rejected because of length of time required, even if the city could act independently of the state.

2. Periodically flushing by a smaller storage reservoir at Mt. Morris. Rejected because agreements with the state and owners of water rights along the river are practically impossible; and if possible, results would be unsatisfactory.

3. Constant flushing of the lower river by pumping water from Lake Ontario or Irondequoit bay. Rejected because a 20-fold dilution would cost $2,077,000 and a 14-fold dilution would cost $1,744,000, and for other reasons.

4. Clarification of sewage by sedimentation at works located a mile and a quarter north of North street, at a cost of $1,270,000. Rejected because the growth of the city in that direction would be stopped; because the partial purification contemplated would become inadequate, and because, in case water-storage projects are carried through, the city would become liable for part of the cost of increasing the minimum flow of the river.

5. Clarification of sewage by chemical precipitation at works located a mile and a quarter north of Norton street. Same plan as No. 4 except that the annual operating expense that the the annual operating expense would be $36,000 as against $25,000 and the cost $1,490,000, or $220,000 more. Rejected for the reason given as to No. 4 and the danger that the cost would be greatly exceeded, while there is an uncertainty as to how the interests of the city would be affected by legislation.

6. The plan favored by the engineers of screening and discharging the sewage into the lake through a conduit of masonry 4.36 miles in length and a pipe at least 7,000 feet in length. The total cost including cost of operation is estimated at $1,194,300—less than that of any other plan. With regard to this the engineers say:

This plan involves the interception of the dry-weather flow of sewage from all of the principal outlet sewers, except the one for the northern district of Lake avenue. As no power can here be generated from the sewage, the discharge of the West Side Trunk sewer must be pumped by steam power for 120 days per year, at a cost of $4,000. The screening must be done throughout the year at a cost of $8,000. Cost of system of intercepting pipes and conduits from upper falls to intersection of Strong and Hollenbeck streets, including West Side Trunk sewer pumping station and 10 per cent. for contingencies, $344,300; cost of masonry from Strong street to shore of lake and submerged outlet pipe, $572,000; assumed cost of about 100 acres of land surrounding screening and detritus tank, $38,000; total cost, $954,300. Annual operating expenses as above, $12,000.

In this project, the great advantage is secured of excluding the normal flow of sewage from the river throughout the entire year, thereby rendering the lower portion of the stream unquestionably salubrious and attractive for pleasure navigation. The sewage will be permanently out of sight, and judging from the experience gained in other large cities on the Great Lakes, no serious contamination of the lake water or pollution of the beaches will ensue. It is also very probable that a considerable reduction of cost can be secured by the use of a wooden stave pipe for the long submerged outlet in place of the riveted steel pipe.

Spring Polluted by Leakage from Trenton, N. J., Sewer.

The State Sewerage Commission of New Jersey has completed the investigation of the source of pollution of the spring which has been blamed for the recent typhoid epidemic at the State Hospital at Trenton. Boyd Mac Lean, secretary of the Sewerage Commission, stated that the pollution of the spring and the typhoid epidemic was due to the sewage flowing underground from the Trenton city sewer in Asylum road into the asylum spring, and this spring was used as a source of part of the drinking water of the asylum.

Pollution of Sea Beaches in New Jer- Must Stop.

The State Sewerage Commission of New Jersey at a conference of city

officials of Asbury Park, Ocean Grove, Allenhurst and Deal, August 1. emphatically stated that pollution of the ocean must cease. The commission had issued notices to the municipal officials between Seabright and Point Pleasant to be present at the conference, and about a dozen responded, all expressing a desire to do away with the offense.

Charles R. Fuller, of Bayonne, president of the commission, said that power to prohibit the dumping of garbage in the ocean had been conferred upon the commission by the legislature, and that cities have the opportunity to appeal from their decisions to the Court of Chancery.

The commission is determined to abolish all the ocean sewage outlets along the coast within two years and will send the cities peremptory notices to change their disposal methods, besides outlining a general plan.

WATER AND LIGHT

Saginaw Water Supply Improvements — North Carolina Water Power—New Jersey Water Commission—Frankfort Water Rates—Municipal Gas Plants—Chicago Light from Canal—Pittsburg Heat and Light Company—Steel Electric Conduits.

Argument for Proposed Water Supply Improvements in Saginaw.

The Saginaw Evening News calls attention to the fact that the city of Saginaw, Michigan, "suffers from an epidemic of 6-inch water mains." It says:

Even the two big mains upon which the east side depends, the one on South Washington and the other on Owen street, are far from adequate for the service required of them, but in the meantime are doing remarkably well considering the odds. But the pitiful little six-inch main, which has afflicted the city these many years, and from which it would almost seem there is no escape, is an aggravation and a nuisance. For small jobs of lawn sprinkling, etc., etc., this type of main may probably be depended upon if there is any kind of moderation shown in the neighborhoods through which they pass, but for effective service in time of need, what can be expected, especially when they get towards the ends of the trunk mains, and the pressure has depreciated to a mere trickling of water, barely sufficient for swimming purposes for the fish occasionally emitted by the service?

And yet, these small mains are continually being increased in number at request of aldermen who seem to be afraid the fellow in the next ward is getting more than his share, and who is apparently of opinion his constituents will imagine they are being neglected unless the name of their "native" son appears more frequently in the official records.

It would appear that the time has about arrived to take these matters up on a system, to see that small mains are eliminated as far as is possible, and to pay more attention to those already laid. There has been suggested to The News the need of a system laid out by a competent hydraulic engineer, one that shall cover the whole city, and which taking into consideration the levels, natural conditions, distance to be traversed, etc., ets., shall lay down a map which must not be departed from. This would seem to be a business-like proposition and one of the first things to be taken up, and the sooner the better.

Then until the plumbing service is put upon a basis where it can be relied upon not only in times of fireless peace, but in case of conflagration war, it would be well to consider the propriety of absolutely ceasing to install new mains. This looks like a radical move, but the situation is so serious as to call for something which shall disturb the condition of lethargy into which the cty appears to be sunk. It certainly verges upon the ludicrous to keep installing numbers of six-inch mains, when it is known that those already in commission inevitably fall short of performing the work they are supposed to do.

Many there are who in discussing the situation, strongly favor the idea of a centrally located and consolidated pumping station such as was suggested during the late campaign for this improvement and a filtration plant. Apart from the pure water question, the consolidation idea grows in favor by reason of unquestionable increase in efficiency for fire protection, and whether there is consolidation or not the objection to the east side pumping staton will always stand that it is so far away, a gigantic depreciation in pressure can never be overcome. On this matter The News will have more to say, but in the meantime and as an immediate necessity, the claims of the auxiliary pumping station have precedence and should be given attention.

Large Water Power in North Carolina.

The completion of the largest coffer dam in the southern states has been announced by the Whitney Reduction Company, of Salisbury, N. C. More than $1,500,000 has been expended in spanning the Yadkin river, 31 miles from Salisbury. The dam is 46 feet high, 917 feet long, and the minimum flow of water gives 46,000 horse-power. The water will be turned on the turbines on January 1, 1908, and all of the industries within 40 or 50 miles will be supplied with electrical power. Complete, the plant will cost $7,500,000.

New Jersey's State Water Supply Commission.

The State Water Supply Commission of New Jersey met in Trenton September 3 and adopted a resolution questioning the legal right of certain corporations to divert waters of various streams, including the Passaic River, and requesting the attorney general to take up the matter for investigation. The resolution was presented by J. H. Bacheller, comptroller of Newark, and met with the unanimous approval of the commisioners. The resolutions are as follows:

Whereas, It is commonly reported that certain corporations are illegally diverting water from streams in this state;

And whereas, due to the extreme dry season, the abstraction of water from the low flow of some of the streams, notably the Passaic River and its tributaries, has resulted in unsanitary conditions; therefore, be it

Resolved, That the attorney-general be requested on behalf of the State to investigate the status of the several corporations diverting water from streams in this State where such diversion depletes the low flow of said streams and thereby conduces or tends to increase the unsanitary conditions along said streams below the point of said diversion, and if such investigation reveals a questionable right on the part of any corporation causing or tending to cause these unsanitary conditions the attorney general is hereby requested to bring suit on behalf of the State to cause such illegal diversion to cease.

A set of rules by which the commissioner are to be governed was adopted. These rules provide for regular meetings on the first and third Tuesdays of each month, and the president is empowered to call special meetings when necessary. Meetings will be held at Trenton or such other places as are designated, and a branch office is to be maintained in Newark, where the public may get information about the work of the commission. All applications or complaints, upon which the commission is expected to act, must be in writing and must be substantiated if required by one or more affidavits, setting forth the facts and circumstances which are made the basis of the application or complaint. Applications for a new or additional source or sources of water supply shall show the location of the source of the present supply, and the source of the proposed supply and approximate location of the proposed reservoir or other works with their estimated capacities, an abstract of any official reports relating to the same, and a statement setting forth the need for such additional supply and the reasons for the locations selected. The commission shall give notice by advertising in one or more newspapers having a circulation within the territory affected by the proposed works of public hearings, at which all persons or municipalities affected by the proposed plans may be heard for the or against the granting of the application. In accordance with the law the commission shall within ninety days after receiving applications either approve or reject the same, or stipulate the terms and conditions under which the approval of the commission is granted.

A majority of the five members of the commission shall constitute a quorum for the transaction of business, but the approval or rejection of plans or the formulation of terms and conditions for new or additional sources of water supply will require the concurrent action of at least three of the members of the commission, and the said concurrent action must be in writing and signed by a majority of the commission.

It shall be the duty of the secretary of the commission to serve notice upon all municipal corporations, corporations or persons engaged in supplying the inhabitants of any municipal corporation with water to file on or before the first day of July of each year with the commission, sworn statements covering the preceding calendar year as to the amount of water diverted, the communities and population supplied, the rates charged and any other matters in connection with the water supply as may by the commission from time to time be directed to be furnished. Said secretary shall present to the commission at its first meeting in October a statement of all persons who have failed to comply with the provisions of this rule.

It shall also be the duty of the secre-

tary, in accordance with the law creating the commission, to demand of the officers in control of all municipal or other water works, a quarterly statement of the amount of water used, as ascertained from accurate records by meters or other approved methods of measurement. Said quarterly statements to cover the quarters beginning on the first day of January, April, July and October of each year, and the reports are to be made to the commission within thirty days after the expiration of the respective periods covered by said reports.

All instructions and authorizations in regard to water supply matters can only be made by an employe of the commission upon the specific direction of the commission.

Present at the convention were former Governor Foster M. Voorhees, chairman of the commission, commissioners Richard Morrell, of Passaic, George F. Wright of, Paterson, J. H. Bacheller, of Newark, Harry G. Humphreys ,of Camden, several members of the Passaic River Flood District Commission, and State Geologist Henry B. Kummel.

The Frankfort Water Works Rates.

The Frankfort, Ind., Water Works Company recently made a new contract for water supply with the city and a revision of its rates. For the information and convenience of its customers and because they are a part of every contract for water service, Mr. J. B. Marvin, the secretary and superintendent, has issued a booklet containing the rules and regulations of the company, with hints and information for customers, the regulations of plumbers and the table of rates to private consumers. The booklet is of convenient pocket size and the printer's work has been well done.

Some extracts from the rates are given to show the tendency of recent contracts in regard to rates.

A family in a house of six rooms pays $5 a year for a single faucet, for each additional room 50 cents and for each additional faucet $1. It pays $3 for the first bath tub and half-price for each additional tub, $3 for first water closet with self regulating faucet and $2 for each additional closet. The charge for each stop closet is $1.50. Hot water faucets over fixtures with cold water faucets are permitted without extra charge. A family in a 6-room house probably pays, therefore, from $12 to $15 a year for water. The maximum charge for a family is $20 a year.

Sprinkling hose, 3-16-inch orifice, for 66-foot lot, the standard size of residence lot in Frankfort, costs $4 a year with 6 cents for each additional foot of frontage and $1 additional charge on corner lots if the side street is sprinkled.

Private stables are charged $3 for first animal and $1.50 for each additional, the charge including all other uses about the stable except hose, which is covered by the sprinkling charge.

The list of rates includes many items for business and manufacturing uses of water.

Meter rates range from 20 cents per 1,000 gallons for 5,000 gallons a month or less, with minimum charge of $1 a month where meter is furnished at consumer's request, and 16 cents for 5,000 to 50,000 gallons a month, to 6 cents where more than one million gallons a month are used.

Municipal Gas Plants.

According to Brown's "Directory of American Gas Companies" there are many small municipal gas plants in the United States. There are 67 such plants in towns of less than 1,000 population, most of them furnishing acetylene or gasoline gas. There are 28 in towns and cities between 1,000 and 10,000 population, 16 of these supplying coal and water gas in quantities varying from 1,520,000 to 45,000,000 cubic feet a year. The prices in these small plants for gas for lighting purposes range from $1 in Dalton, Ga., to $4 in Cartersville, Ga. The government plant at West Point charges 75 cents. For fuel purposes the prices vary from 75 cents at West Point, N. Y., and Bellefontaine, O., to $2.20 at Middleboro, Mass., where, notwithstanding the high price, 70 per cent of the gas is used as fuel.

Larger cities having municipal plants are:

Norwich, Conn., charging $1.25 and selling 36 million cubic feet a year.

Henderson, Ky., charging $1 and selling 25½ million.

Holyoke, Mass., charging $1.20 and selling 128 million.

Wakefield, Mass., charging $1.40.

Westfield, Mass., charging $1.30 and selling 18,150,000.

Escanaba, Mich., charging 75 cents for fuel and $1.35 for lighting and selling 2 million.

Duluth, Minn., charging 75 cents and selling 112 million.

Alexandria, Va., charging $1.20 and selling 44 million.

Danville, Va., charging $1 and selling 42 million.

Richmond, Va., charging $1 and selling 388,687,000.

Wheeling, W. Va., charging 75 cents for lighting and selling 116 million cubic feet a year.

Philadelphia has leased its plant. The price of gas is $1 and the output 8,711 million cubic feet a year.

Danville and Louisville, Ky., own small proportions of the stock in their companies. Danville sells gas at $1.12½ and the output is 9½ million a year. Louisville sells for fuel at 75 cents and for lighting at $1, and the output is 525 million.

New Heat and Light Company for Pittsburg.

The Duquesne Heat and Light Company, of Pittsburg, contemplates building a heat and light plant which is to rival that operated by the Philadelphia company, which now has a monopoly of the business in Allegheny county. The Philadelphia company recently advanced the price of gas 30 cents a thousand feet. The Duquesne Heat and Light Company has arranged for a loan of $10,000,000 and purposes to issue bonds for the loan negotiated, and expects to erect a modern electrical plant to cost $1,500,000. Mayor Guthrie of Pittsburg recently asked Governor Stuart of Pennsylvania to bring quo warranto proceedings against the Philadelphia company to annul its charter. Governor Stuart refused to do this, however, notifying Mayor Guthrie that he should apply to the Attorney General of Pennsylvania and not the Chief Executive.

Lighting Chicago Streets From the Canal.

The negotiations between the city of Chicago and the Sanitary district which have been pending for a year past regarding the use of electrical power for street lighting purposes have reached a conclusion and the contract is signed, pursuant to an order passed by the council June 3. The electricity is to be delivered by the Sanitary district at Western avenue. The contract provides for 7,000 horse-power. The city has the option of using the power either twenty-four hours each day, or for an average of eleven hours per day ranging from eight and one-half hours in May, June and July to fourteen hours in November and December. The price to be paid is $1.25 per month per horse-power on the eleven hour basis and $2.20 on the twenty-four hour basis.

It was understood long ago that the electrical power would be delivered at cost, but a stubborn dispute arose about the propriety of including certain items in the estimate of actual cost. The trustees of the Sanitary district fixed upon $26.40 a year or $2.20 a month as the actual cost to the district of delivering the energy at the terminus. The figures upon which this estimate was based are as follows:

Interest at 4 per cent on cost of development and transmission	$140,000.00
Taxes on real estate and buildings	7,620.00
Depreciation	13,517.94
Labor, repairs and incidentals	68,140.00
Operating Lawrence avenue pump station	43,960.00
Operating Thirty-ninth street pump station	120,380.00
Interest at 4 per cent on investment at Thirty-ninth street station	15,599.76
Total annual cost	$409,217.70

The trustees estimated that with the present flow in the canal they could deliver 15,500 horse power at the substation at Western avenue. If the total annual cost as above estimated is divided by 15,500, the result is an annual cost of $26.40 for each horse power.

It was strenuously insisted by the city electrician and Frank J. Bennett, chairman of the Finance Committee of the council, that the basis of computation was radically wrong and items for interest and for operating the pumping stations, aggregating $319,939.76, should be eliminated altogether, leaving only $89,277.94 as the annual cost of 15,500 horse power. On this basis the actual cost per horse power would be $5.76 a year instead of $26.40, a very striking difference.

The question about including the interest on the entire cost of the plant involves to some extent that of the supposed identity of the Sanitary district with the city of Chicago. Some contend that inasmuch as the taxpayers of the city and of the Sanitary district are "practically identical," the trustees ought to furnish to the citizens of Chicago for the mere cost of transmission, the electrical energy paid for by the citizens of the district. This position was subsequently abandoned. If there was only one Sanitary district taxpayer outside of the city of Chicago, he could undoubtedly prevent

the consummation of any such scheme for lighting the city at his expense. The position taken by the sanitary trustees finally prevailed, and the contract is drawn accordingly.

Even at $26.40 a year or $2.20 a month, the cost of electric lights will be greatly decreased. At the close of 1905 there were 6,687 arc lamps in operation in Chicago. The average cost of maintenance and operation of these, after allowing for depreciation, interest and insurance, was $55.34. Under the contract with the sanitary board the average cost of the same number of lamps for a twenty-four hour service will be $30.40.

Steel Conduits for Electric Wires.

A committee of the National Board of Fire Underwriters is investigating the methods of use of steel conduits for electric wires with a view to improving them where necessary. The committee is calling for assistance and wants answers to the following questions, the communications to be sent to The Underwriters' Laboratories, Inc., 382 Ohio St., Chicago, Ill.:

1. In what respects, if any, does the ordinary form of enamel on rigid conduit prove an unsatisfactory covering for the steel pipe?

2. Does galvanized rigid conduit possess advantages or disadvantages as compared with enameled conduit? If so, what and for what special uses?

Note:—The claim has been made that galvanized pipe in the presence of moisture, especially in concrete, suffers from "local action," that is, a corrosion due to electrical action in the presence of the two metals and traces of acid. Well substantiated evidence of such effects is especially desired if the effect is known to have been observed.

Rule 25f. Must have the metal of the conduit permanently and effectually grounded.

It is essential that the metal of conduit systems be joined so as to afford electrical conductivity sufficient to allow the largest fuse or circuit breaker in the circuit to operate before a dangerous rise in temperature in the conduit system can occur. Conduits and gas pipes must be securely fastened in metal outlet boxes so as to secure good electrical connection. Where boxes used for centers of distribution do not afford good electrical connection, the conduits must be joined around them by suitable bond wires. Where sections of metal conduit are installed without being fastened to the metal structure of buildings or grounded metal piping, they must be bonded together and joined to a permanent and efficient ground connection.

3. Does the enamel ordinarily used on conduit and fittings (junction outlet and panel boxes) prevent or render difficult strict compliance with this rule of the National Electrical Code?

If so, what commercially practicable means can be found for obtaining better conductivity?

Note—At the meeting of the Underwriters' National Electrical Association in March, 1907, it was suggested that the following be added as a fine print note in Rules 24a, 25d, 25f, of the Code:

"It is recommended that galvanized cables, outlet boxes and fittings be used in order to secure a better electrical contact at all points throughout the cable system."

It was also suggested that a note be added to Rule 49a-b to read:

"It is recommended that the protective coating (of switch and outlet boxes) be of metal such as tin or zinc."

These suggestions were referred to a special committee for consideration and report.

4. Definite information is desired as to the use of conduit in cement or concrete.

(a) Conditions liable to cause deterioration of conduit, either rigid or flexible in cement or concrete.

(b) Do flexible conduits or armored cables placed in wet concrete admit water to the interior while concrete is setting to a degree sufficient to cause trouble? If so, what precautions should be taken or what limitations should be placed to such use of flexible conduit or armored cables?

5. What injurious effects on exposed conduits are observed from the action of acid fumes and gases. In such cases what may be done to protect the conduits from rapid deterioration?

6. What added specifications for construction and installation of junction boxes should be made? See Code Rule 49a, which treats of Switch and Outlet Boxes and Rule 25b and g.

7. What defects, if any, are found in present types of

(a) Ordinary conduit outlet boxes?
(b) Junction boxes?
(c) Grounding clamps?
(d) Fittings for use with flexible conduit and armored cables?
(e) Fittings for use with exposed rigid conduit such as "Condulets" and similar devices?

8. What other defects, not suggested above, have been noted in present forms of conduit or fittings? What means may be taken to correct such defects and what additions or revisions of the present Code rules on conduit are desirable?

It will be understood by all persons receiving this circular that our purpose in sending it is not to imply any doubt as to the large measure of fire protection afforded by steel conduits and their fittings, but rather to aid and encourage the development of these products which have already proved themselves of distinct benefit to the insurance interests.

CEMENT AND PLASTER

Cement Industry—Gypsum Production.

The Cement Industry in 1906.

The production of cement in 1906 amounted to the enormous total of 51,000,445 barrels, valued at $55,302,277, exceeding by 10,897,137 barrels in quantity and $19,370,744 in value the production of 1905, which had been the banner year. Classified according to character the production was as follows:

	Barrels.	Value.
Portland cement..	46,463,422	$52,466,186
Natural cement...	4,055,797	2,423,170
Puzzolan cement..	481,224	412,921

These figures are reported by the United States Geological Survey in an advance chapter from "Mineral Resources of the United States, Calendar Year 1906," and are somewhat greater than those given in the preliminary statistics of production issued by the Survey early in the year, the difference being due to the fact that some of the returns were received too late for use in the first statement.

The most prosperous branch of the industry is, of course, the Portland cement branch, whose growth has been of the most phenomenal character. Twenty years ago, when the Portland cement output of the entire United States stood at about 250,000 barrels against nearly 7,000,000 barrels of natural cement, the first attempt was made to introduce the rotary kiln for the manufacture of Portland, the company exploiting the new process proudly claiming the ability to produce 30,000 barrels of cement per annum, and to triple this quantity as soon as the necessary grinding machinery should be added. To-day it is not considered in the least sensational if a company announces the capacty of its plant 3,000 to 5,000 barrels a day, while the yearly production of the large plants runs well into the millions of barrels.

The decline of the natural cement industry has been gradual, but as steady as the increase of the Portland branch. In 1906 the effect of this decline has seemed to be even more widespread than in the preceding year. The owners of many plants have allowed them to remain idle, some have turned their attention to lime-burning and kindred employments, and a few have dismantled the old plants and established buildings and machinery for making Portland cement. Since some of the limestone, known as "cement rock," from which the natural cement is made forms an equally good base for Portland cement, the last course would seem to be both logical and wise.

The growth of the slag or puzzolan branch of the cement industry is interesting because of its steadiness. The advantage of the industry is that it consumes a product of steel and iron foundries which has for years been regarded as waste. This variety of cement is not burned in rotary kilns and should not be confused with Portland cement made with slag as a basis and burned in rotaries.

Although the prices at which cement was sold in 1906 were higher than those which prevailed in 1905, they were not inflated but resulted from a normal growth in demand. The producers made no complaint of prices, but protests against the insufficient car service provided for the delivery of orders were made from every part of the United States.

That the quantity of cement exported by the United States to foreign countries is not so large as it should be is probably due to the great home demand, but with continued increase in production, the foreign trade can not be long neglected.

The statistics of the industry have this year, as in the past, been prepared by L. L. Kimball, and the report is prefaced by a chapter on Advances in Cement Technology by Edwin C. Eckel. The pamphlet is now ready for distribution and may be obtained without cost by applying to the Director of the United States Geological Survey at Washington, D. C.

The Production of Gypsum in 1906.

The increase in the use of gypsum in the form of plaster is quite as phenomenal as the increase in the use of Portland cement.

The gypsum mined in the United

States in 1906 amounted to 1,540,585 short tons, valued at $1,147,129.

This production represents an increase in quantity of more than 47 per cent., and in value of nearly 40 per cent., as compared with that of 1905, and exceeds that of any previous year.

The material is produced in 17 States and Territories besides Alaska, and in connection with the mining, mills for grinding and burning it are operated at nearly all the places of production. As to relative rank among the States producing gypsum, Michigan still holds first place, New York regains second place, and Iowa is a close third. The other States show few changes since 1905, their present rank being as follows: Texas, Ohio, Oklahoma, Kansas, California, Wyoming, Virginia, Nevada, Oregon, Utah, New Mexico, Colorado, South Dakota, Alaska, and Montana.

Gypsum occurs in sedimentary rocks of practically all ages, either in the crystalline form or as rock gypsum, and it is widely distributed over the world. It is found commonly in the vicinity of beds of rock salt. In the United States workable deposits are confined to beds of rock gypsum, which occur at comparatively few geological horizons. New deposits of gypsite—the earthly, granular form of the mineral—are reported to have been recently discovered in Riverside County, Cal., and many newly developed deposits are reported from other parts of the country.

The bulk of the gypsum produced in the United States as well as in foreign countries is manufactured into various plasters—such as plaster of Paris, stucco, cement plaster, flooring plaster, hard-finish plaster—and a steadily increasing quantity is being used as a retarder in Portland cement. Refined grades of plaster are used in dental work and also as cement for plate glass during grinding and as an ingredient in various patent cements. Considerable quantities are ground without burning and are then used as land plaster or low-grade fertilizer, while smaller quantities are used in the manufacture of paint and paper, imitation meerschaum and ivory, and as an adulterant. The pure white, massive form, known as alabaster, is much used by sculptors for interior ornamentation.

MUNICIPAL AND TECHNICAL LITERATURE

Classification of Engineering Knowledge—Municipal Reports—New Publications.

Classifications of Architectural, Engineering and Building Knowledge.

The Engineering Experiment Station of the University of Illinois has just published Bulletin No. 13, "An Extension of the Dewey Decimal Classification Applied to Architecture and Building." This greatly extended classification has been in use in a more comprehensive form in the department of Architecture for many years, but it has never before been published. It forms a supplement to the extended classification applied to the branches of engineering previously issued in Bulletin No. 9.

It is preceded by a very brief explanation of the exceedingly valuable system invented and introduced by Dr. Melvil Dewey for the classification of books and literary materials, but which has since been found to be the best known method for arranging all tangible things and ideas. For the convenience of persons not fully conversant with the system, and for finding the proper numbers quickly, a relative index of subjects has been added. In its present form it is believed that this bulletin will prove useful to architects, engineers and constructors in classifying books, pamphlets, articles in periodicals, data and all other material relating to architecture and construction.

Copies may be secured upon application to the Director of the Engineering Experiment Station, Urbana, Illinois.

New Publications.

Hendricks' Commercial Register of the United States for Buyers and Sellers. Sixteenth Annual Edition. 1224 pp. cloth, $10. Samuel E. Hendricks Co., 74 Elm St., New York City.

From the title page the following description is taken:

"Especially devoted to the interests of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying, exporting and kindred interests. A complete and reliable annual index of the aforesaid industries, containing over 350,000 names and addresses, upwards of 15,000 business classifications, with full list of the manufactures of and dealers in everything employed in the manufacture of material, machinery and apparatus used in these vast industries, from the raw material to the manufactured article, and from the producer to the consumer. Indispensable as a buyers' reference for the architect, engineer, contractor, manufacturer, jobber, retailer, purchasing agent and for railroad, machine-shop, foundry, mill, factory, mine and plantation, also indispensable for mailing purposes."

While one can always pick out inaccuracies in a directory of this sort, the completeness of this directory is very remarkable and that it is kept as nearly up to date as possible is shown by the guaranty which accompanies the list of architects which would more than reimburse the user for postage and printing lost by errors in the list, and which could not be given if the list were not practically correct, and the changes in it, to be had for the asking, were not up to date.

Municipal Reports.

Water Commissioner's Report, Guthrie, Okla., 1906-7. W. S. Spencer, Commissioner.

The plant pumps an average of 315,000 gallons a day or 114,676,000 gallons a year, which is distributed through 682 taps, of which 162, or nearly one-fourth are metered. The metered taps used 46,207,917 gallons, or over 40 per cent of the total pumpage and the receipts from metered water were $7,309, which was slightly over 60 per cent of the total receipts from water rents. The head against which the pumps work is not stated, but the cost of pumping, figured on the pump house expense, is 5.37 cents and on the total operating expense is 8.5 cents per 1,000 gallons.

The balance sheet of the department is shown by three different methods, and by all of them the plant is apparently successful. Thus the receipts from water rates are $2,403.84 greater than the maintenance and operating expenses, showing 25 per cent profit on the outgo. If the city is charged $50 for each fire hydrant and schedule rates for water used for street sprinkling and furnished free, it more than offsets the interest on the bonds and this method of book-keeping shows a balance of $3,232.84, or 22 per cent. profit. Taking the water receipts from all sources, rates, $12,116.35, taxes, $6,639.37, materials sold, $197.02, they amount to $18,952.74; disbursements are, maintenance and operation, $9,712.51, new construction, $2,902.98, new materials, $607.72, repairs and taps, $1,071.81, on city accounts not connected with water works including fire department expense, $4,576.40, making a total of $18,871.42, so that there is a balance of receipts of $81.32 after payment for the new construction and the payment on account of other city funds. Receipts from the city taxes very nearly balance with payments on the city's account and value of water furnished for city purposes, so that the water works revenues are sufficient to meet all expenses of maintenance and operation, interest charges and new construction. The expenditures for new construction are equivalent to a depreciation charge of nearly 6 per cent.

The report would be improved by the use of the standard form of summary of water works statistics.

Pure Water at Atlantic City.

Samples of water forwarded to Philadelphia and tested by Harry Leffman, a chemical expert, show that the water of Atlantic City, N. J., according to Mr. Leffman's report, ranks with the best. The report, in which all figures, unless otherwise noted are in parts per million, is as follows:

Artesian Well — Total solids, 45; chlorin, 6; nitrogen as nitrates, none; nitrogen as nitrites, traces; free ammonia, traces.

Pond—Total solids, 65; chlorin, 9; nitrogen as nitrates, none; nitrogen as nitrites, traces; free ammonia, none.

Bacteria per cubic centimeter, after four days' cultivation at room temperature in neutral agar-agar, Duplicate tests made, (a) artesian, none; (b) none. Pond—(a) four; (b), four.

A test was also made of the bacteria in the water as drawn from the spigot at City Hall, which showed no colonies.

ORGANIZATIONS AND INDIVIDUALS

American Society of Municipal Improvements—League of American Municipalities—New England Water Works Association—Engineering Schools —Municipal Librarian—Technical Meetings—Personal Notes.

The American Society of Municipal Improvements at Detroit.

The fourteenth annual convention of the American Society of Municipal Improvements will be held at Detroit, Mich., October 1, 2 and 3, 1907.

On Tuesday, October 1st, the executive committee will meet at convention headquarters, Cadillac Hotel, at 10 a. m., and delegates will report at the same place for registration, badges, credentials, etc.

The afternoon session at 2:00 p. m., at the Light Guard Armory, will include an address of welcome on behalf of the city of Detroit, by his Honor, the Mayor, and a responsé by the first vice-president, James Owen, of Montclair, N. J. Regular order of business will then be taken up including reports of the secretary, treasurer and finance committee. These will be followed by the report on Municipal Data and Municipal Statistics, by James W. Howard, chairman, Consulting Engineer, New York City, the report of committee on Municipal Franchises, by R. H. McCormick, chairman, City Engineer, Detroit, Mich., and papers on topics relating to these subjects.

At the morning session, at 9:30 a. m., on October 2 will be given the report of the committee on Taxation and Assessment, by W. H. V. Reimer, chairman, City Engineer, East Orange, N. J., the report of the committee on Disposal of Garbage and Street Cleaning, by T. Chalkley Hatton, chairman, Consulting Engineer, Wilmington, Del., the report of the committee on Sewerage and Sanitation, by Charles H. Rust, chairman, City Engineer, Toronto, Canada, and papers on topics relating to these subjects.

The election of officers and selection of next place of meeting will also take place.

The afternoon will be occupied by a drive to view points of interest in Detroit, and the evening will be devoted to papers descriptive of Detroit, and papers on general topis.

Thursday morning, October 3, at 9:30 a. m., will be given the report of the committee on Electric Street Lighting, by E. A. Fisher, chairman, City Engineer, Rochester, N. Y., the report of the committee on Water Works and Water Supply, by J. L. Ludlow, chairman, Consulting Engineer, Winston-Salem, N. C., and papers on topics relating to these subjects.

During the afternoon session, beginning at 2:30 p. m., will be given the report of the committee on Review, by A. Prescott Folwell, chairman, New York City, the report of the committee on Street Paving, by Allan Dow, chairman, Chemical Engineer, New York City, and papers on "Disadvantages of the Long Time Guarantee and Maintenance of Street Pavements from Contractor's Standpoint," by W. H. Andrews, of Hamilton, Ohio. on "Specifications for Treating Wooden Block for Paving," by George W. Tillson, Chief Engineer, Bureau of Highways, Borough of Manhattan, New York City, and papers by Messrs Hittle and Harper on topics relating to Street Paving.

At the evening session, 8 p. m., will be presented the report of the committee on City Government and Legislation, by Horace Andrews, chairman, Consulting Engineer, Albany, N. Y., the report of the committee on Fire Protection, by Alcide Chausse, chairman, Superintendent of Buildings, of Montreal, Canada, papers on "Fire Protection," by F. W. Fitzpatrick, Consulting Architect of Buildings, Montreal, Canada, and the report of the committee on Park Development and Maintenance, by Jas. Owen, Consulting Engineer, Montclair, N. J.

The city of Detroit is sending out a handsome little invitation card to city officials all over the country and has appointed local committees to look after the pleasure and profit of members and guests attending the convention.

The League of American Municipalities.

The League of American Municipalities held its annual convention at Norfolk, Va., September 18, 19 and 20. One of the principal addresses on the first

day was that by Allen Ripley Foote, president of the National Tax Association and commissioner of the Ohio State Board of Commerce on the subject of "Low Rates for Public Service vs. Franchise Taxation." He said:

The most useful tax to place on public service corporations, is to require them to provide a service capacity much greater than is sufficient to supply present demands, and to extend their service lines beyond present paying limits, thus causing them to serve as a factor in improving and building up the ever-widening limits of the municipality, increasing and diversifying the industries of its inhabitants and contributing to their comfort and prosperity. Investments in public service utilities should be limited only by the requirements to be provided for, and the right of way for their service lines should be unobstructed.

Taxes upon the property of public service corporations not only enhance the cost to the users of the services, but they accomplish this for the benefit of non-users and alien property owners.

The policy of low taxes, or no taxes, should not be adopted unless the interests of the people are well safeguarded by legal requirements that will make it certain that they will receive offsetting advantages in correspondingly low charges for services rendered. The demands of economic law should find correct expression in the conditions created by statutory laws.

To secure the best possible public services at the lowest practical price, economic law requires that a public service corporation organized to supply a perpetual public need shall have the exclusive right to supply such need perpetually; that all accounts shall be honestly and correctly kept; that economic thrift shall be insisted upon in every department, and that charges for the use of these services shall bear a fixed relation to the necessary cost of production.

A comparison of these economic conditions with the laws of all States will clearly show how unintelligently well-meant efforts have been directed in all attempts to secure for public and private users the services supplied by public utilities by placing dependence upon the principle of competition instead of the principle of governmental regulation.

That the statistics of municipal affairs, and of public service utilities, however owned and operated, may be properly developed, it is necessary that the State shall establish a department of public accounting and inspection, as an independent department of state, properly organized and equipped, to cover all features of municipal affairs, and of the public utilities that supply the public needs of municipalities and of their inhabitants.

Under a system of State regulation, such as is here advocated, every interest of users, of municipalities and of the State, will be best served by granting exclusive, perpetual and untaxed franchises to public service corporations. When operating under such conditions, public service corporations can render the best obtainable service at the lowest profitable rates, and can satisfy the users of their services that they are doing so.

On the second day William H. Allen, secretary of the Bureau of Municipal Research, New York City, discussed the defects in the city charters and said the following regarding such forms of city government as that of Galveston and Des Moines:

But it should not be forgotten that the advocates of government by commission have heretofore failed to recognize three fundamental facts: (1) Misgovernment in a democracy is due primarily to ignorance on the part of the general public as to official acts and community needs; (2) misgovernment by commission is possible because the commission plan of itself does not insure intelligence on the part of the general public as to government results and community needs; (3) hundreds of communities in the United States, including New York city, are now being misgoverned by commissioners.

The goal of American democracy, should be government by the public and not by a few or many officers. Government by the public is impossible and always will be impossible whenever government is uninformed or misinformed. Unless the commission plan provides for an intelligent electorate, it would misgovern.

Equal rights can extend no further than equal intelligence. Special privilege always has existed and always will exist where intelligence about government is monopolized by the few. No matter how intelligent a commission, it would misgovern, unless those governed had the essential facts possessed by it, regarding what it did and what it left undone.

Rear-Admiral French E. Chadwick, United States navy, spoke in explanation and advocacy of the Newport (R. I.) system of municipal government, also devoted part of his address to a comparison of American and European forms of city administration, declaring that the American people had much to learn in this respect. He said:

The first need is an understanding of this subject of municipal administration. American towns as a rule have simply been the subject of exploitation through a long series of years for the benefit of seekers after political power or for what we have come to call graft. We have sat in grumbling humor throughout this era without sufficient energy or public spirit to free ourselves. The situation which we are attacking is one of unparalleled national disgrace.

The admiral said he had become convinced that the main cause of our failure is in placing city administration, which demands thorough knowledge and experience, in the hands of haphazard, short-term men.

The system adopted in Newport, R.

I., and very successful thus far in its operation, is in a great degree a return to popular government. It is when analyzed a system of a small body of administrators, six in all, who are completely responsible for the manner in which administration is carried on. But all power of taxation, appropriation of funds, appointment to the more important city offices is in the hands of a body which we call the Representative Council.

Admiral Chadwick declared the Des Moines charter to be a long step from the crudity of the Galveston system. Its vital defect, in his view, is in leaving the whole money power in the hands of one small body of men.

Ex-Mayor, J. M. Head, of Nashville, Tenn., said:

A glaring absurdity under which our city governments have labored is the idea that our cities are mere branches or arms of the State government, and have, and can exercise no powers except as the State Legislature may from time to time permit. This idea entirely ignores the cardinal doctrine upon which all our governments are based—the doctrine of local self-government—and places our city governments practically under the control of men who do not reside in the cities, and who know absolutely nothing of their local needs and requirements. These are radical defects in the present organization of our city governments.

Other speakers were Mayor W. D. Harris, Fort Worth, Tex., and Emerson Coatesworth, of Toronto, Can., who favored the commission plan of city government and Mayor R. C. Rhett, of Charleston, S. C., who opposed it; also John R. Davis, chairman of the finance committee of the New York city Board of Aldermen and Hugo S. Grosser, city statistician of Chicago, Ill.

On the last day municipal ownership was the principal topic for discussion. One of the principal speakers was Edward A. Moffitt, secretary of the National Civic Federation's investigation committee who spoke unfavorably of municipal ownership in America. He contrasted conditions in America, where it is "difficult to get truly responsible men to fill positions of responsibility in vital and responsible affairs," with those in European municipalities, which secure "high-class men who have no interest in city affairs save the good of the city. There you find no bosses and political leaders are unknown."

President Dunn of the League and others advocates of municipal ownership answered many of his arguments.

A paper by H. J. Gonden, of Chicago, presented the views of corporations regarding "Regulation vs. Municipal Ownership" but was mainly directed against municipal ownership with some consideration of phases of regulation of public service corporations.

The league adopted a resolution for the appointment by the president of a committee from each state to recommend measures for the "enlightenment of all our citizens in the forms of good government."

The following resolution was adopted:

Resolved, That many of the defects and difficulties in the government of American cities result from the refusal of legislatures to grant charters permiting local self-government in matters of purely local concern and that the utmost liberality in matters of local concern should be insisted upon by all municipalities seeking charters from the state.

The league adjourned after selecting Omaha, Neb., for the 1908 convention. Officers were elected as follows:

President—J. Barry Mahool, mayor of Baltimore.

Vice president—Silas Cook, mayor of East St. Louis, Ill.

Secretary-treasurer—John MacVicar, Des Moines, Ia.

Trustees include William J. Morey, mayor of Ft. Wayne, Ind., and Mayor Joyner, Atlanta, Ga.

New England Water Works Convention.

The twenty-sixth annual convention of the New England Water-Works Association was held at Springfield, Mass., September 11 to 13.

The first paper submitted was on "The Springfield Water-Works," by Elbert E. Lochbridge, chief engineer of the Springfield Water department. This paper, which traced the development of the water supply of Springfield from its institution to the $2,000,000 addition that is now in course of construction, was discussed by a number of members.

F. A. Barbour submitted a paper on the "New Water-Works Plant at Peabody, Mass.," in which he gave chronological data showing the growth of a typical pipe line designed only for the existing generation and replaced by the next: 1797, 3-in. log pipe; 1804, 6-in. iron pipe; 1850, 12-in. iron pipe; 1865, cement and wrought iron 15-in pipe. The plan for the plant was purchased from a company in 1873, and at that time changed from a gravity to a pumping system. The needs of a larger service have recently necessitated the enlargement of the plant, to which the paper was

largely devoted. A large circular masonry reservoir, which has been built on the crest of one of the hills around Salem, is the leading point of interest in the new system.

A paper on the "Computation of the Value of Water Power," was read by Charles T. Main, of Boston. This was followed by one on "Water Rights," by Richard A. Hale, The discussion which followed this paper gave particular attention to the principle of "repaying in kind" for diverted water power, or the establishment, by the city or state diverting the water from any mill, of another water storage or supply from which the mill can get a power equally as good as the one taken away. Though attempted in a few cases, its legality is questioned.

"The Waltham Reinforced Concrete Reservoir" was the subject of a paper by Bertram Brewer, city engineer of Waltham, Mass., who described the reservoir, stating that it is the fourth reinforced-concrete tank or stand-pipe in this country, and while not as high as some others, it has the largest capacity. The tank is 100-ft. in diameter and 35-ft. inside height. It is built on a ledge of solid rock, with a slab floor 12-in. thick, reinforced with wire mesh. The side walls are 18-in. thick at the bottom, rising with constantly battered outside face to a 12-in. thickness. The walls are reinforced with horizontal circumferential 1 1-8-in. round rods with 40-in lap joints. The rods are spaced 12 ins. c. to c., vertically, in horizontal rows of three for the lower 20-ft. and in rows of two for the remainder. The walls are connected to the base by a curved inner surface and by 1 1-8-in. rods, which extend 6 ft. into the base slab and are bent up into the wall for 3 ft. The top of the tank is covered with a steel truss roof, radiating from a concrete pipe support in the center. The Waltham reservoir has been filled with water for about a year and as yet no leaks have appeared. To reach this water-tight condition the following precautions in construction were taken. The sand and stone were carefully analyzed to procure the best mechanical mixture for the filling of the voids, and the material which went into the concrete was thoroughly cleansed before using. Two waterproofing compounds, the Medusa compound and hydrated lime, were tested in trial mixtures, and although both showed good results the lime was the cheaper and hence was used, 5 per cent. by volume with the regular 1:2:4 mixture. Great care was taken in laying the steel that none of it should be loose and so easily jostled out of position when the concrete was half set, thus leaving holes. To insure the stability of the steel, the horizontal reinforcing rods were set in vertical latticed angle and plate columns. The forms were tied together with detachable bolts, which left the center portion in the concrete when set. In joining new concrete to old at the day's work joints, the old surface was carefully washed and all debris and laitance removed. Immediately before placing the new concrete, a light wash of cement grout was applied. In only one case has the slightest dampness shown at any of these points, that place being one where from some needs of the erection plant concreting was shut down for five days in very dry and hot weather. As a final precaution, the entire inside of the reservoir was lined with a mortar coat. For the lower 9 feet this coat consisted of a 1:3 cement mortar with 10 per cent. hydrated lime and 5 per cent. Medusa compound; for the upper portion it was merely a cement grout. With the above precautions for waterproofing an entirely satisfactory structure has been completed. In the discussion that followed this paper various members gave their experience in the waterproofing of concrete, and special attention was called to an instance in East Orange, N. J., where a leaky concrete tank was made water-tight by a threefold application of the so-called Sylvester process of coating with alternate layers of Castile soap and alum.

"Cast Iron Pipe Specifications" was the subject of a paper by William R. Conard, of Burlington, N. J., in which he advocated several minor improvements in the specifications on pipe now standarized by the association.

Hiram A. Miller, chief engineer of the Charles River Basin Commission, of Boston, read a paper on "The Charles River Basin." This basin is a water park now in course of construction on the Charles River, the pond in which is formed by damming the river near its mouth. A back water is thus formed extending a considerable distance up-stream and lined on either side by wooded parks. Outside of the great possibilities in landscape gardening on these park banks, the main points of engineering interest in the work are to be found in the construction of the sluiceways and lock through the dam at the lower end of the basin. The lock is built of sufficient size to permit the passage of boats with 17-ft.

draft. It is of concrete masonry throughout, reinforced slightly, against temperature strains principally, and founded for most of its length upon pile footings. The concrete mixture is 1:3:6, crushed granite being used for stone. A mortar facing of 1:3 mix is applied to all inside surfaces. The showing surfaces of the dam, sea-walls and locks are of ashlar granite. Expansion is provided for every 40 ft. by means of tenon joints filled with tar. By legislative order the lock must be workable in winter, so it was necessary to devise a unique system of heating the lock gates to prevent binding from ice. This has been solved by rolling gates working somewhat on the principle of the rolling lift bridge, built of hollow steel work, through which steampipes are run. As the Charles at this point carries some of the storm water pipes of the combined sewer system of Boston, it was necessary to build marginal conduits along either bank which carry this excess sewage parallel to the stream.

Notes of Engineering Schools.

A circular has been issued by President Brown Ayres, of the University of Tennessee, outlining the courses in mining engineering and geology. These subjects have been taught in the university in past years, but the recent appropriaton to the university by the legislature has enabled it to provide for new professorships in both subjects, and for equipment for the departments, so that the course in mining and metallurgy will hereafter be greatly enlarged and strengthened.

An electric laboratory has been established in Manila, Philippine Islands, by the Jesuit fathers, to teach electrical science. The course lasts five years.

Appointment of Newark's Municipal Librarian.

In response to a communication from MUNICIPAL ENGINEERING regarding the appointment of a municipal librarian, we are advised by Hon. Jacob Haussling, mayor of Newark, N. J., that while the ordinance providing for the appointment has become effective, the common council which makes the appointment has not yet acted in that direction owing to a contest for the place, and will not, at the earliest, before the first Friday in October.

Technical Meetings.

The next convention of the League of California Municipalities will be held at Pasadena, Cal., during the week commencing November 11. The city officials of the League will be divided into departments, each with its official head, and besides the Department of Engineers and Street Superintendents already organized, there will be a department of City Clerks, Auditors, and City Attorneys, and probably a department of Fire Department Officials. The State Association of Health Officials and the fourth district Library Association have been invited to hold their sessions at the same time. The Improvement Clubs of the southern part of the sate will be requested to form a federation, and the civic sections of the Women's Clubs will be asked to hold a meeting at the same time.

The seventh annual convention of the Union of Canadian Municipalities was held at Fort William and Fort Arthur, Ont., August 12, 13, 14, 15 and 16. The program included addresses as follows: "Some Present Municipal Problems," S. Morley Wickett, Toronto; "Municipal Ownership, Its Difficulties and Advantages," Joshua Dyke, ex-Mayor of Fort William; "Municipal Electric Supply," D'Arcy Scott, mayor of Ottawa; "The Municipal Development of a Manufacturing City," J. W. Bowlby, mayor of Brantford, Ont.; "City Government by Commission," W. A. Greisbach, mayor of Edmonton, Alta; "Electric Light for Streets and Municipal Buildings," J. A. Robb, mayor of Valleyfield, Que.; "Some Difficulties of a Mining Town," P. J. Finlan, mayor of Cobalt, Ont.; "Problems of Municipal Financing," J. G. Kinnaird, commissioner of Edmondton, Alta.; "Problems of a Cosmolpolitan City," H. A. Ekers, mayor of Montreal, Que.

The second annual convention of the Illinois Mayors' and Municipal Association was held at Bloomington, Ill., September 11 and 12. The program included the following papers: "The Commercial Needs of a Great City," Milton J. Foreman, alderman, of Chicago; "The Value of Interurban Lines to Our Municipalities," George Shumway, mayor of Galesburg; "Permanent Improvements," W. A. Penneck, mayor of LaSalle; "The Duties of a City Engineer," Wallace Treichler, city engineer of Rock Island; "Municipal Legislation," Edward Shurtleff, speaker of house of representatives; "City Parks," Thomas O'Connor, mayor of Peoria.

The second annual meeting of the American Gas Institute will be held at Washington, D. C., October 16, 17 and 18. Jas. W. Dunbar, secretary, New Albany, Ind.

The joint convention of the American Civic Association and the National Municipal League will be held at Providence, R. I., November 19, 20 and 21. Clinton R. Woodruff, secretary, North American Bldg., Philadelphia.

The Southern Association of Cement Users will holds its first convention at Atlanta, Ga., in October during the week of the state fair.

The American Forestry Association, Thos. E. Will, secretary, 1311 G. St., N. W., Washington, D. C., is asking for members to aid in the campaign for forest reservations where they will aid in the preservation of streams, and is especially asking for contributions for use in pressing the acquirement of the proposed reservoirs in the Appalachian mountain regions, both north and south.

The American Peat Convention will meet for organization at the Jamestown Exposition, Norfolk, Va., October 23 to 26. There will be an exhibit of peat in the Mines and Metallurgy building and also at the fuel testing plant of the U. S. Geological Survey.

Personal Notes.

E. C. Woodward is now city engineer of Fort Worth, Texas.

C. H. Gore has been elected city engineer of Aurora, Ind.

E. H. Randall has been elected city surveyor of Fredericksburg, Va.

Alonzo K. Crowell has been elected city engineer, at Taunton, Mass.

J. J. Kirkpatrick has been appointed superintendent of water-works, at Holyoke, Mass.

W. L. Daniel has been elected mayor, at Saluda, S. C., to succeed L. M. Crouch, resigned.

L. J. Wagner has been elected superintendent of the Rome Water-Works, at Rome, Ga.

James C. Van Trump has been appointed superintendent of the water department, at Wilmington, Del.

F. J. Seery, of Ithaca, N. Y., has been appointed an assistant engineer in the office of the New York State Engineer and Surveyor.

Harry T. Poe, Jr., has resigned as assistant engineer with the American Pipe Mfg. Co., to become city engineer of Americus, Ga.

William Ogden, a graduate of the Stevens Institute of Technology, Hoboken, N. J., has been appointed city civil engineer, at Madison, Ind.

Charles R. Long, for many years president of the Louisville Water Company, Louisville, Ky., died at his home in that city, September 4, aged 67 years.

Rudolph Hering, of New York City, has been chosen by the Passaic Valley Sewerage Commission to prepare plans for a trunk sewer to drain the Passaic Valley.

J. C. Van Doorn has been appointed northwestern sales agent of the Universal Portland Cement Company, with office in the Security Bank Building, Minneapolis, Minn.

Edwin S. Slack, for many years superintendent of the Somerville Water Company, Somerville, N. J., died at his home in Raritan, N. J., recently, of paralysis, aged 55 years.

Owen A. Cahill, president and secretary of the Newark Paving Company, Newark, N. J., and a former member of the board of freeholders, died recently of rheumatism of the heart.

H. P. Boardman resigned recently as engineer in charge of branch canals for the Sanitary District of Chicago, to become Professor of Civil Engineering in the University of Nevada, at Reno.

L. A. Waterbury, Assoc. M. Am. Soc. C. E., and for the last four years Instructor in Civil Engineering at the University of Illinois, has been appointed Professor of Civil Engineering at the Universty of Arizona, at Tucson.

Samuel Marshall, president of the Milwaukee Cement Company and founder of the oldest bank in continuous existence in the northwest, died at his home in Milwaukee, Wis., September 1, of Bright's disease, aged 86 years.

E. W. Cummings has resigned as Erecting Superintendent for the Pittsburg Filter Mfg. Company to accept a position with Bowman Bros., contractors of McKeesport, Pa., in charge of the construction of the new filtration plant in that city.

Judge E. H. Gary, of the U. S. Steel Corporation, is reported as having become the manging head of the Allis-Chalmers Company, of Milwaukee. Judge Gary has been connected with the latter company since its formation, but has not heretofore taken active part in its management.

Horace Ropes, formerly connected with the Metropolitan Water Board, of Boston, and the New York City Board of Water Supply, has been engaged by the New York State Water Supply Commission to assist John R. Freeman, director of the engineering forces of Water Supply Commission.

J. G. Ellendt and O. L. Griffith have severed their connection with the Concrete Engineering & Supply Company, of New York City, and together with C. E. Tirrell, have organized the J. G. Ellendt Co., with offices at 1 Madison Avenue, New York City. They will engage in consulting engineering and contracting on reinforced concrete work.

J. W. Howard, consulting engineer on roads, streets and pavements, 1 Broadway, New York City, has been called upon by the commissioners of acocunts of New York City, to assist Governor Hughes, of New York, in his investigation of John F. Ahearn, president of the Borough of Manhattan, regarding the bad state of asphalt and other pavements and the causes of their neglect.

MACHINERY AND TRADE

The Ronberg Shovel.

To many contractors a shovel is a shovel, but to the man who is looking for the best there are many points of importance about the design of a shovel. The Conneaut Shovel Co., of Conneaut, Ohio, has taken up all these points and is making special shovels for special purposes. The following are the points made concerning their design of a shovel for sand, shale and ore, and they claim it will work one-half easier than the ordinary shovel and fit the hand better. The blade and socket are all in one piece of high carbon crucible steel, re-tempered and rehammered, thus toughening the blades so they will not break. The edge is tempered like a file for a half-inch in depth and the temper is then drawn back about two inches farther with a hammer striking 500 blows a minute. This tempering gives strength in the bearing point of the shovel. The corners of the blade are not turned up to strike obstructions in driving the shovel under its load. This gives a perfectly straight flat edge and makes it 15 to 20 per cent. easier to drive the shovel under its load than the ordinary shovel. There is a strong, stiff backbone, giving plently of strength to break the load loose after the shovel is driven under it. The handle, of finest quality second-growth white ash, is two inches shorter than the ordinary shovel handle and it is hung so that the handle comes to a man's knee. He can thus drive it under the load with the least possible effort, and, because he grasps the shovel nearer the load, he lifts it with greater ease. The shovel itself weighs about a pound less than other shovels, the strength being retained by the quality and the tempering of the material.

The Conneaut Shovel Co. will send full information concerning their various designs of shovels and copies of enthusiastic letters from contractors and others who have found them right for their work.

Street Signs for Omaha.

The city council of Omaha, Nebraska, is considering two propositions for the installation of street signs at every street intersection in the city. The American Sign Company, of Clyde, Ohio, submitted a proposition to furnish the necessary signs to mark the thoroughfares, which will cost the city, according to local press reports, about $45,000. Another company offers to do the work free and maintain the signs in first-class shape for a period of seven years, and will pay the city a royalty of five per cent. of its gross receipts from advertising. The advertising cards would be of the same style as the street sign, and each would be 6 by 18 inches in size. It is provided that there shall be no objectionable advertising matter thus displayed. Councilman Sheldon desires the sentiment of the citizens as to whether or not the city shall expend $45,000 and not have the advertising plate, or accept the plate and secure for the city treasury, according to the promise made, of more than that sum from the royalty. No provision is made for the appointment of a censor of the advertising and there is likely to be considerable difference of opinion as to the acceptability of advertisements and the materials advertised.

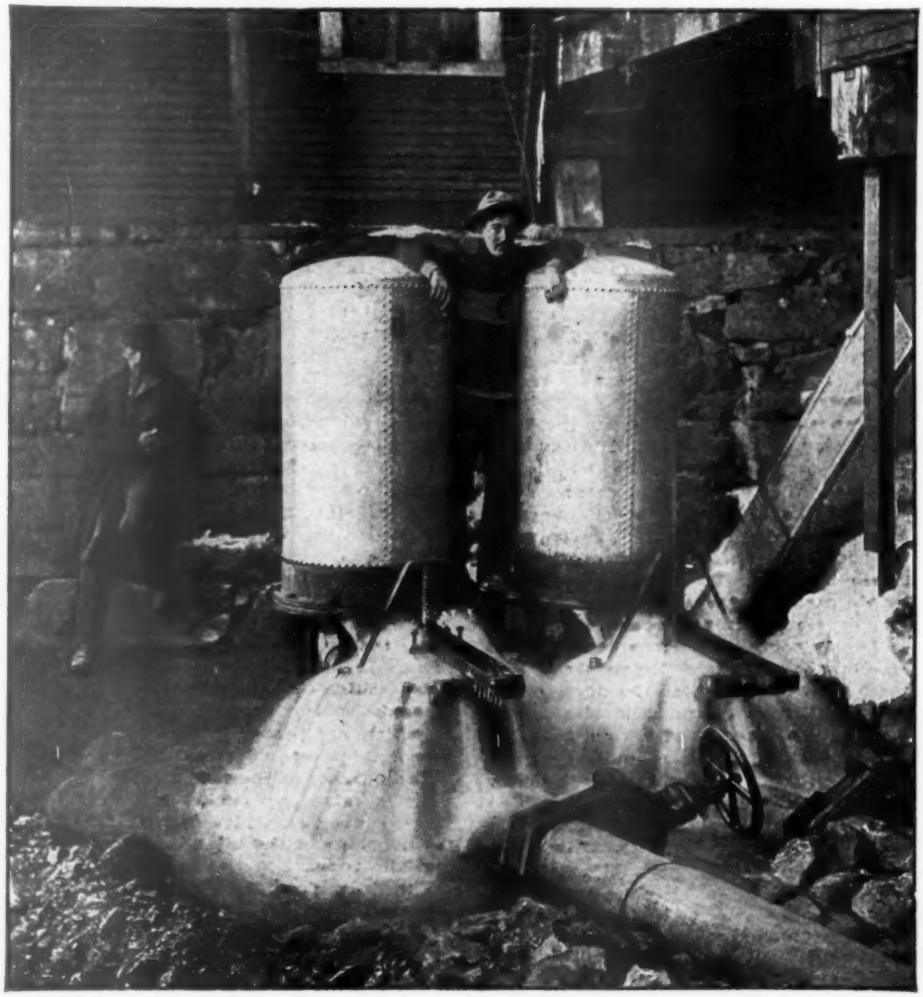
Strength of Hollow Concrete Blocks.

That concrete blocks properly made are capable of withstanding enormous crushing strain is borne out in the following test made by Professor Crocker of the Mechanic's Institute, Rochester, N. Y. A block made on a Hercules machine by Palermo Bros., Mount Morris, N. Y., having 126 square inches, total area, and net area, deducting air space, of 100 square inches, crushed at 181,000 lbs., which is equivalent to 1,436 lbs. per square inch total area and 1,810 pounds per square inch net area.

A second test was made with a block produced on a Hercules machine operated by J. F. Norris, Brighton, N. Y. size of block, 8 by 12 by 24 inches. This block was subjected to 200,000 lbs. crushing test and refused to break. The limit of the testing apparatus having been reached, it was impossible to learn how much additional weight

would be required to break the block.

The two blocks submitted were regular stock blocks made of good material, mixed with a two to one facing and a five to one backing. According to Hercules methods a sufficient amount of water had been used when the blocks were made to insure perfect chemical action.



RIFE HYDRAULIC RAMS DELIVERING UNDER 200 FEET HEAD.

Proper Size of Hydraulic Ram.

The Rife Hydraulic Engine Manufacturing Co., 111 Broadway, New York City, issue the following instructions for determining the data necessary for selecting the proper Rife hydraulic engine and making the proper connections:

In order to determine the proper size of engine to be used, it is necessary to make a careful survey to obtain the following information:

1. Flow of water in gallons per minute.
2. Vertical fall in feet.
3. Distance in which fall is obtained.
4. Vertical height above engine water is to be raised.
5. Distance water is to be raised.
6. How many gallons required per day.
7. If a double-acting engine is required, flow in gallons, of the spring water per minute; and the fall, in feet, from spring to engine.

First—Determine this by the time necessary to fill a vessel of known capacity from the source of suply.

Second—Find the difference between the level of the surface of the water in the source of supply and the lowest point within a reasonable distance.

Third—Give the distance.

Fourth—Find the difference between the level of the proposed location of the engine and the highest point to which the water is to be delivered.

Fifth—Length of pipe necessary to conduct the water from the engine to point of delivery.

The accompanying cut shows two Rife hydraulic rams supplying 100,000 gallons daily to a reservoir 200 feet above the ram.

The Kansas City Portland Cement Works.

A 2,000-bbl. mill has recently been completed by the Kansas City Portland Cement Co. on the Atchison, Topeka & Santa Fe R. R. near Kansas City. It is built from the plans of Mr. W. H. Caffery and is located at the base of a high bluff composed of alternate strata of limestone and shale.

Tramway tracks lead from the base of quarry to the crusher building, cars being conveyed to the inside and dumped. The building is located on the side of the bluff on a bench quarried out of solid rock, built of concrete, and is 100 feet above the center of the main building. The crushed rock and shale pass by gravity from crushers to the dryers, which are located in a separate dry house, built on a bench below the crusher building. Below the crusher building are located the dry storage bins. These bins are built of concrete and have a capacity of 900 cu. yds. The tops of these bins are built up to a level with the floor of the dryer building, and extend partially under it. The crusher building is equipped with two Austin gyratory crushers, which are operated by electric motors. In the dry room are two rotary dryers, each 60 ft. long and 6 ft. in diameter. Dry shale storage is provided for with a bin built beside the rock storage bins. The capacity of this bin is 300 cu. yds.

Special weighing cars are operated on narrow gauge tracks which extend into the dry material bins from the edge of the bluff at the bottom of which is located the main plant. This track is all under cover and the man in charge at this plant has telephone connection with the chemical laboratory. The main mill building is 100x530 ft., and is 30 ft. in height to eaves. The foundations of this building are all of concrete, the superstructure being steel frame, sided with 2 inches of 1 to 3 cement mortar, laid on expanded metal. A concrete floor is laid throughout this building.

Eighty per cent. of the power used in the entire plant is supplied directly by the machines, and the other twenty per cent. is transmitted electrically. The power plant occupies a space of 110x100 ft. in the main building, and is divided from the remainder of the interior of this building by dust proof walls, constructed in the same manner as the outside walls.

The engine room contains two 1,000 h.-p. cross-compound condensing straight Corliss engines and three 200 k.-w. 440 volt, three-phase, alternating-current generators, two of which are each directly connected to a 300 h.-p. four-valve Hamilton engine. The third being held in reserve, is connected by belt to a main line shaft. The engines are all operated condensing.

Water is supplied to the plant from a pumping plant located on the river bank above high water mark. Here centrifugal pumps are used, operated by electric motors. The bottom of the pump pit is below extreme low water mark. Water is siphoned into the pump pit through two 14-in. pipes, a small air pump being used to start the flow.

The raw materials machine room contains six Jeffrey hammer mills, and six tube mills, all being belted to the main line shaft extending through the room. In addition to screens built in these mills, the materials are passed through rotary screens, the tailings of which are passed back to the hoppers by bucket elevators.

The product of the raw material tube mills is raised by bucket elevators to screw conveyors, which deliver same to the housings of the kilns in the adjoining kiln room.

The kiln room is 100x210 ft., and contains four 8x125 ft. rotary kilns, and three 6x60 ft. rotary clinker coolers. Four kilns are set in pairs, with one housing to each pair. The kilns are fired by oil, at three pounds pressure, the Little low pressure system with blower and large nozzle being used. Each kiln is driven separately by a 30 h.-p. variable speed motor. Rotary coolers are also each driven separately by 30 h.-p. variable speed motors. Clinker is delivered by a bucket elevator from the kilns to coolers. Coolers discharge into one-yard, side-dump, ball-bearing Koppel cars, which are raised to an elevated track by a motor driven freight elevator.

The clinker storage bin, built of re-

inforced concrete, has a clinker capacity of 50,000 barrels. The finishing room is 68x126 ft. in size, and contains 14 Bradley Griffin mills, and four standard tube mills. Bucket elevators handle the product from Griffin mills to tube mills.

From the elevator, the finished product is delivered to cement stock house by screw conveyors. The stock house is built of reinforced concrete divided into four bins, which have a total capacity of 125,000 barrels. The packing room in the stock house is equipped with electrically driven packing machines, and automatic scales. Two switch tracks, each 1,000 ft. long, extend alongside the stock house, giving ample room for cars.

The Use of Tarvia in Chicago and the Results.

The following description of the method of tarviating several boulevards in Chicago was written by Linn White, the Chief Engineer of the South Park Commission:

In preparing for the Tarvia, the surface of the macadam was first cleaned of all road detritus. The upper three inches of the macadam was then thoroughly loosened with picks in the wheels of a road roller, which was followed by a team with a harrow. The macadam along the edges of the drive which had not been reached in this manner was loosened by hand. As the stone was very dry below the surface it was thoroughly sprinkled after it had been loosened. The wet stone was then rolled well with a 10-ton steam roller, and when it had compaccted thoroughly was allowed to dry on the surface before the Tarvia was applied. Tarvia was then distributed over the road from buckets and a layer of limestone screenings was rolled in with a steam roller. After 24 hours, traffic was admitted to the tarviated area.

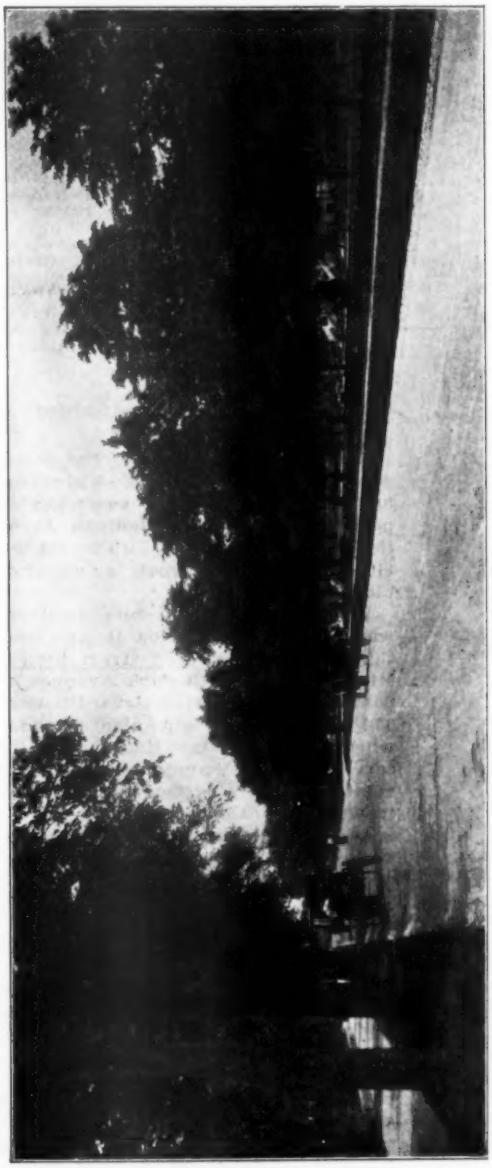
The central one of three drives on Grand Boulevard, which drive is 50 feet wide and 2 miles long, together with approaches at each end of this boulevard, with a total of 68,651 square yards and about 17,600 square yards of drives on Drexel Boulevard were also tarviated in practically the same manner that has already been described.

In much of this work not on Michigan Avenue, it was only necessary to thoroughly clean and level the surface of the macadam before applying the Tarvia, as the traffic has in few places been heavy enough to have had such a bad effect on the macadam as on Michigan Avenue. At some places not on the latter it was necessary, however, to do considerable work in leveling up the surface and in adding screenings before the Tarvia was applied.

The results obtained by tarviating the surface of the macadam are considered sufficiently satisfactory to justify the continuance of the work on a more extensive scale during the coming season.

The Tarvia penetrated the macadam to a slight depth only, and in some cases the coating of Tarvia was not over 1-8 inch thick. It effectually protected the macadam, however, against the action of the motor-car wheels so long as it remained intact, and on a large portion of the drives where it was applied no resurfacing was required in the spring.

At the same time, the necessity and cost of sprinkling were greatly reduced



TARVIATED SECTION OF DREXEL BOULEVARD, CHICAGO.

where the Tarvia was employed, the estimated saving of sprinkling on the tarviated surfaced over the amount required on surfaces not tarviated being about 60 per cent. Practically the only sprinkling required was that necessary to lay the dust blown on the tarviated surfaces or brought on by traffic. As sprinkling a 40-foot macadam drive has been found by the South Park Board of Commissioners to cost on the average $97.37 per mile per month during the season of 8 to 9 months, the actual saving in sprinkling alone is considerable.

On the other hand, the tarviated surfaces have been dustless and in good condition for traffic in all kinds of weather, while the untreated surfaces become quite loose and raveled in soft weather under automobile traffic and are difficult to keep free of dust at other times.

These additional benefits derived from the tarviated macadam surfaces over those not tarviated would seem alone to justify the tarviating, but the expectation is to be able to fully warrant the continuance of the latter on a purely financial basis.

Bitulithic Contracts Awarded in Chicago.

Ever since the spring of the present year the South Park Commissioners have been considering surfacing the present macadam on Michigan Avenue Boulevard from 22d to 39th street with either bitulithic, asphalt or creosoted blocks.

While Michigan Avenue Boulevard was under consideration it was found that a portion of 33rd street between Michigan and South Park Avenues and South Park Avenue Boulevard between 33d and 35th streets, also macadam, which had been resurfaced with macadam this year, again required treatment—so severe is modern automobile traffic on macadam roads.

Accordingly, on August 7th, in pursuance of advertisement, proposals were received for resurfacing with bitulithic the three boulevards described.

The lowest bids received for each class of pavement, as canvassed by the Chief Engineer of the South Park Commissioners, including recurbing, and scarifying the old macadam, were as follows:

Bitulithic—Chicago Bitulithic Company $155,035
Asphalt—Barber Asphalt Paving Company 128,395
Creosoted Wood Block—Citizens' Construction Co. 160,586

The aggregate area of work between curbs was 72,623 sq. yds. and width 50 feet.

The South Park Commission sent their Chief Engineer, Linn White, and Asst. Supt. Mr. Harry S. Richards, through the eastern, middle and western parts of the United States and Canada to investigate all forms of pavement in the cities visited. On September 16, the contract was awarded for bitulithic, notwithstanding the large preference in price. The work is to be completed this fall, with two plants.

Mr. J. F. Foster, superintendent of the South Park Commission, says that the automobile has brought up entirely new conditions for consideration in the matter of boulevard roadways. On their important boulevards, including Michigan Avenue and South Park Avenue now to be resurfaced with bitulithic, they find it necessary to give the macadam at least three complete dressings a year at an expense for each dressing of seven cents per square yard or twenty-one cents per square yard per year. It should be here noted that these boulevards are absolutely restricted to pleasure driving and by actual count over two-thirds of all vehicles passing over the boulevards are automobiles. The effect of the automobiles is to suck the fine particles of stone or dust (on which the macadam depends for its cementing material) from between the particles of stone and then the larger particles quickly ravel. This weakness of macadam under automobile traffic is destined to open a wide field for bitulithic and other permanent pavements.

Good Hotel Accommodations for A. S. M. I. Delegates.

Mr. M. A. Shaw, manager of The Tuller is sending invitations to all members of the American Society of Municipal Improvements to make his hotel their headquarters while attending the Detroit meeting, October 1-4. A booklet which is enclosed with the invitation describes and illustrates this beautiful new hotel, which is located on West Grand Circus Park at the corner of Adams and Park streets. The courteous invitation, the convenient location, and the attractive printed matter will undoubtedly draw many delegates to The Tuller.

Sarco Filler for Block Pavements.

It is interesting to read a carefully prepared and conservative statement by the manufacturer concerning his product and the following concerning Sarco filler for brick pavements is selected from a letter written from the office of the Standard Asphalt and Rubber Co. to a paving contractor because

it gives a good idea of the qualities of the material:

It keeps the block or brick in proper position.

It thoroughly protects the corners and edges of the block or brick.

It cannot be washed out or swept out of the points.

Water cannot penetrate it and reach the foundation.

It is thoroughly sanitary.

It adds half as much strength to the pavements as the ordinary concrete foundation.

It does not run under the summer's heat or become brittle in winter, and cannot be ground into dust, and at all times remains flush with the block or brick, and prevents the wheels of passing vehicles from jolting and rattling over the joints with a rumble and a roar.

It takes care of the expansion of the block or brick, and there is no rumbling sound.

Openings in the pavement can be more easily made and repaired than where a cement grout filler is used.

To preserve the life of a block or brick it is very essential that the edges be carefully protected, to prevent them from becoming chipped or broken. Sand, by the continued vibration of traffic, settles deeper and deeper into the crevices, or joints, leaving the blocks or brick, in a short time, entirely unprotected. Portland cement becomes very rigid. Coal tar is somewhat better, when not exposed at all to the changes of weather, but its range of temperature is so short that it does not last very long; in cold weather it becomes brittle, is ground to dust, and is blown away. In hot weather it softens and runs.

Sarco asphalt filler adheres to the sides of the block or brick, remains flush with the top, is unaffected by the changes of weather, gives to the expansion or contraction of the pavement, does not disintegrate. Sand, like other disintegrating fillers, leaves large cracks between the blocks or bricks, which, becoming permeated with street liquids, makes a veritable breeding spot for all sorts of disease germs. Sand is less noisy than cement filler, but fully reduces the noise of traffic to a minimum.

Sarco weighs 8 pounds per gallon, one ton yielding 250 gallons. From 1 1-8 to 1½ gallons per square yard is usually required, this depending upon the distance the blocks or bricks are placed apart.

The Standard Asphalt and Rubber Co., Chicago, Ill., will give full information about the uses of their asphalt products.

Trade Publications.

Catalog 69 A of the Jeffrey Mfg. Co., Columbus, O., is devoted to their line of standard and special screens of which they manufacture all kinds and designs for treating bone ash, trap rock, chemicals, clay, coke, plaster, slate, marble, ores, quartz, carbon, sand, Portland cement clinker, blood, graphite, phosphate rock, limestone, acid phosphate, Fuller' earth, chrome ore, fire clay, and all kinds of sharp and gritty materials. They also design and build any special screens not shown in their large list. Appliances for use about the screening plant are included in the catalog, which is one of the more than a dozen books required to show the many lines of machinery made by the company.

The Forbes Co., Philadelphia, has issued circular No. 2 on sterilizers.

The Atlas Portland Cement Co., 30 Broadway, New York, has issued a very fine second edition of its book of "Concrete Country Residences," which has many additions to the already large and good list of handsome pictures of plain, reinforced and block concrete houses, cement plastered buildings, etc. The book is well worth the price of one dollar charged for it.

The Goheen Mfg. Co., Canton, O., prints a report of tests of the spreading power of various paints.

The McWane Pipe Works, Lynchburg, Va., issue monthly a vest pocket memorandum book which gives the latest information about the cast iron pipe trade and prices.

Trade Notes.

ASPHALT.

Milwaukee, Wis.—The establishment of an asphalt repair plant is favored by C. W. Yockey, alderman.

Wilmington, Del.—The directors of the street and sewer department decided, Sept. 17, to purchase and install a municipal asphalt paving plant.

BRICK.

The Bloomfield Vitrified Brick & Tile Co. will establish a new brick manufacturing plant. T. H. Schmitz, of Chanute, Kas., and C. C. Stein and Lloyd Begeman, of Westphalia, are interested.

CEMENT.

Chicago, Ill.—Edward Quebbeman has been appointed St. Louis Agent of the Universal Portland Cement Company, with office in the Chemical Building, St. Louis, Mo. Mr. Quebbeman succeeds J. C. Van Doorn, who was transferred to the Minneapolis office.

Medicine Lodge, Kas.—The new gypsum plaster cement plant now under construction will be ready for operation October 1. Thomas J. Best is interested.

Alva, Ok.—The Oklahoma Cement Plaster Co. has been incorporated by D. B. Zimmer, S. F. Harris and D. A. Murphy, of Kansas City, Mo., and J. M. and Ben. F. Bickel, of Alva.

Humboldt, Kas.—The Humboldt Portland Cement Co. has been re-organized with E. D. Schermerhorn, president; S. H. Wilson, A. D. Kendall and Chas. F. Johnson, vice presidents; W. W. Mills, remaining treasurer; J. W. Beery, secretary. With the reorganization the office in Kansas City has been discontinued and removed to Topeka,

where it is located in the Prudential Trust Bldg. The company contemplates beginning the erection of a plant at Humboldt the middle or last of October.

The Sandusky Portland Cement Co., manufacturers of Medusa Water-proof compound report furnishing their water-proofing material for the Grand Rapids, Mich., Refrigerator Co. plant. The material is also being used in the reinforced concrete dam being built by the D. L. & W. Ry. coal department at Scranton, Pa. and it was used in the A. Booth & Co. cold storage plant at Detroit, Mich. The Atchison, Topeka & Sante Fe Ry. is using an immense quantity at Albuquerque, N. M. and Summerville, Texas. Albert Kahn, architect, used the material throughout the construction of his private residence just completed.

CONCRETE BLOCKS.

Fort Dodge, Ia.—Northrop & Son, of this city, have purchased several acres of land at Forest City, Ia., and will erect a plant there for the manufacture of cement block and tile, paving blocks, cement posts and ornamental building material.

Fort Atkinson, Wis.—The Fort Atkinson Concrete Block Co. has been organized and will manufacture cement blocks. F. W. Hoard is president, H. H. Curtis vice president and treasurer, and A. C. Price, secretary.

Chehalis, Wash.—Ignatz Unterwegner, of this city, Victor Toerger, of Spokane, and others, have formed a partnership and will erect a plant here for the manufacture of cement blocks.

McLean, N. D.—John Tenny and Jos. Herzog have engaged in the manufacture of cement blocks.

Spencer, Ia.—The Spencer Cement Tile Co. has begun the manufacture of cement posts.

Wausau, Wis.—The Concrete Block & Supply Co. will enlarge and rebuild its plant.

PURCHASE OF MATERIALS.

Selinsgrove, Pa.—Special. The Cement Construction Co. desires to purchase a mixer and brick machine.

Buenos Aires, S. A.—Special—The Barbieane Co., Corrientes 346 al 54, advises us that it desires descriptions, details and catalogues of street sweeping machines for sweeping streets paved with rough stone, drawn by horse. The company has many connections in South American countries and counts in the republic 240 agents.

Los Angeles, Cal.—Sealed bids are asked until 11 a. m. October 7, for necessary machinery for the equipment of a Portland cement plant, with daily capacity of 1,000 barrels of manufactured cement, consisting of three rotary kilns, crushers, pulverizers, dryers, conveyors, elevators, cars, pulleys and shafting, silex mill linings and flint pebbles, etc. Horace D. Ferris, secy., Bd. Los Angeles Aqueduct, Dept. Pub. Wks.

PURCHASE OF MACHINERY.

Gloucester City, N. J.—The General Gas Mantle Co. has been incorporated by John F. Blandy, Joseph H. Van Nest, James M. Coles, and Thomas J. Meehan. The company is to manufacture gas mantles and other lighting devices. John F. Blandy, agent in charge.

Camden, N. J.—The Sun Power Co. has been incorporated to manufacture sun and solar engines, furnish power, etc., by Y. Josephine Shuman, Arno Shuman, Constantine Shuman, Frank Shuman, and Norman Grey.

MISCELLANEOUS.

Santa Monica, Cal.—Estimates have been submitted for constructing municipal piers 1,000, 1,500 and 2,000 feet in length at the foot of Colorado avenue. The estimate will provide for concrete piles. Sewer com. of coun.

WATER.

Prices for 6-inch water pipe are $34.50 to $35 per net ton in New York, $37 to $38 in Chicago and $35 in Birmingham, Ala. Old orders are keeping foundries busy, many having enough to keep them busy several months. Most new business is in carload to 200-ton orders, there being few large contracts in sight. The unsettled condition of the iron market makes quotations irregular.

Patents Pertaining to Streets and Bridges.

800,220. Road Grader. John W. Langpitt, Adel, Ia.

801,111. Bituminous Composition. August E. Schutte, Belmont, Mass.

802,544. Road Grading Machine. Roy E. and Joseph D. Adams, Indianapolis, Ind.

802,888. Road Grader. Nathaniel G. and Justin A. Robinson and August H. Meier, Woolstock, Ia.

803,902. Tar Macadam and Method of Preparing Same. Edgar P. Hooley, Nottingham, Eng.

804,990. Machine for Manufacturing Paving Compounds. Wm. H. Worswick, Alma, Mich.

805,258. Wheeled Scraper. Jas. M. Brooks, Molena, Ga.

805,761. Tread Piece for Sidewalk Lights, etc. Edgar R. Taylor, Boston, Mass.

806,563. Combined Curb, Gutter and Vehicle Track for Highways. John Owen, Pittsburg, Pa.

807,495. Scraper Blade for Road Making Machines.

807,936. Road Scraper. Vincent M. Jackson, Laurel Hill, La.

808,332. Road Grader. Wm. Alcorn, Garden Grove, Ia.

808,339. Road Making. John C. Butterfield, London, Eng.

808,599. Apparatus for Mixing Paving Compositions. Geo. W. Crichfield, Jersey City, N. J.

808,820. Road Grader. Frederick B. Drewes, Granada, Minn.

808,877. Road-Leveling Machine. Clinton D. Smith, Russell, Ia.

809,225. Process of Manufacturing Artificial Paving Stones. Wilhelm Schumacher, Oberdollendorf, Germany.

810,477. Road Grader and Ditcher. Chas. D. Edwards, Albert Lea, Minn.

810,529. Compressible Packing for Wood Block Road Paving. Chas. W. Gregory, Jr., Bristol, Eng.

810,874. Ditcher and Road Grader. John D. Martin, Haynesville, Ky.

811,746. Road Bed. Geo. Ross and Stephen F. Deal, Kansas City, Mo.

812,593. Process for Tarring Roads. Louis Preaubert and Gaston A. Thurbe, Nantes, France.

813,010. Road Grader. John W. Langfitt, Adel, Ia.

813,053. Road Grader. Christian Morsing, Plummer, Minn.

814,797. Pavement. John I. McDonald, St. Joseph, Mo.

816,229. Screen and Storage Bin for Asphalt. Frederick A. Hetherington, Indianapolis, Ind.

819,142. Apparatus for Raising Asphalt Pavement. Wm. E. Kerns, Fox Chase, Pa.

819,833. Composition for Roofing, Paving, etc. Edward J. Yetter, Denver, Colo.

819,904. Railroad Paving Plant. Geo. Merriman, Toledo, O.

820,162, 820,163. Compositions for Roofing, Paving, etc. Edward J. Yetter, Denver, Colo.

825,564. Anchored Block Pavements. Alexander W. Van Hafften and John L. Gilmore, Minneapolis, Minn.

826,265. Rail for Street Railways. Jack McLellan, Philadelphia, Pa.

826,344. Embedding for Street Car Rails. Franz Melaun, Charlottenburg, Germany.

828,734. Means for Removing Asphalt Paving. John Gammie, New York City.

829,002. Wood Paving. Joseph Duffy, Victoria Park, London, Eng.

829,247. Pavement or Roadway. Thos. N. Badger, Emeryville, Cal.

829,293, 829,294. Pavement. Peter C. Reilly, Indianapolis, Ind.

829,480. Paving and Building Block. Edwin H. Mills, Columbus, O.

832,919. Asphalt Cutting Mechanism. John C. Mertens, Chicago, Ill.

833,551. Process of Facing Roadways, Streets and Walks. Geo. Ross and Stephen F. Deal, Kansas City, Mo.

836,059. Pavement Mixture. Walter S. Wilkinson, Baltimore, Md.

836,211. Road Filling and Leveling Device. Wm. A. Pierce, Topeka, Kan.

836,506. Road Leveler and Scraper. Chas. W. Kauffman, Daleth, McLean Co., Ill.

839,347. Road Making Machine. Wm. P. Warren, Sheridan, Ill.

839,424. Method of Producing Pavements. Herman J. Rufli, Mobile, Ala.

840,075. Road Grader. Luther Matthews, Paris, Tenn.

840,139. Combined Grader and Scraper. Geo. E. Lelliar, Elyria, O.

840,305. Road Grader. Ezra Fahrney, Deep River, Ia.

841,647. Pavement. Edward Heylyn, Manchester, Conn.

842,201. Composite Roadway and the Process of Constructing the Same. Solon G. Howe, Detroit, Mich.

843,369. Road Smoother. Robert C. Schreiber, Fairmont, Minn.

845,283. Scraper. Barzilla R. Wheeler, Los Angeles, Cal.

845,508. Composition of Matter for Use as Paving Material. Gabriel Bognar and Alex Toth, Perth Amboy, N. J.

845,910. Road Construction. Chas. P. Walter, Harrisburg, Pa.

845,969. Road Grader. Alexander W. McBlain, Kilduff, Ia.

847,471. Pavement. Freeman F. Gross, Chicago, Ill.

847,793. Road Grader. Winfield S. Livengood, Kansas City, Mo.

848,472. Device for Smoothing Wagon Roads. Frederick W. Lechner, Wenona, Ill.

793,029. Railroad Crossing Gate Mechanism. John Craig and Fred I. Pease, Erie, Pa.

794,605. Apparatus for Treating Timber. Philip H. Gerhard, Austin, Tex.

797,275. Apparatus for Creosoting the Ends of Poles etc. John L. Gilmore, Minneapolis, Minn.

802,739. Method of Preserving and Waterproofing Wood. Joseph A. Deghull, New York N. Y.

804,744. Bridge. Gustav Lindenthal, New York, N. Y.

806,530. Sand Drier. Clark J. Duncan, Windber, Pa.

806,591. Composition for Preserving Piles and Timber. Peter S. Smont, Everett, Wash.

809,264. Truss Bridge. Wm. J. Humphreys, Elmwood, Ill.

809,304. Road Culvert. Wm. Isham and Frank E. Miller, Ionia, Mich.

811,385. Plan for Numbering Streets in Irregular Cities. Frank E. Cudell, Cleveland, O.

818,272. Apr. 17, 1906. Culvert. Harlan G. Moats, Villisca, Iowa.

828,917. Culvert. Thos. Bardon and Chas. E. Wiberg, Ashland, Wis.

832,017. Culvert. Frank Hummel, Newton, Ia.

837,793. Bridge Floor Fastener. John T. Campbell, LaFayette, Ind.

837,796. Bridge. Geo. H. Chavey, Winooski, Vt.

838,893. Street Crossing Indicator. Geo. E. Palmer and Morris H. Cohen, Butte, Mont.

850,382. Process for Surfacing Pavements. Geo. H. Lutz, Kansas City, Mo.

851,114. Bridge. Martin R. Biron, Chicago, Ill.

851,625. Process for Laying Pavement. Walter E. Hassam, Worcester, Mass.

851,712. Gravel Spreader and Road Leveler. David M. Trabue, Mays, Ind.

851,713. Road Working Machine. David M. Trabue, Mays, Ind.

Patents Concerning Sewage and Sewage Disposal.

788,721. Catch Basin Trap. Sylvester A. Johnson, Lincoln, Nebr.

789,940. Sewer Cleaning Device. Robert Shannon, Jersey City, N. J.

790,034. Manhole Cover. Orin H. Davison, Chicago, Ill.

790,245. Cess-Pool or Catch-Basin for Sewers. Paul Mannagan, Lawrence, Mass.

791,078. Sewer Inlet. Simon C. Corson, Norristown, Pa.

791,381. Receiver or Catch Basin. John M. Thompson, Buffalo, N. Y.

794,243. Excavating Apparatus. Wm. J. Newman, Chicago, Ill.

795,680. Manhole Cover. Robert Cameron, Boston, Mass.

795,971. Apparatus for Cleaning Sewers and Drains. Wm. F. Hanaford, Mansfield, Mass.

798,908. Apparatus for Carrying Out Bacterial Purification of Sewage or Drain Water. Christoph Kremer, Gross Lichterfelde, near Berlin, Germany.

799,479. Combined Sewer Pipe and Manhole. Fred'k A. Lovejoy, Boston, Mass.

801,240. Machine for Filling Trenches. Geo. R. Hively, Dayton, O.

802,647. Sewage System Ventilation. Edward V. Koch, Milwaukee, Wis.

810,390. Back-Pressure Trap for Sewer Pipes. Peter J. Bode, St. Louis, Mo.

810,733. Ventilation for Sewer and Other Pipes. Geo. W. Evans, Tuxedo Park, Md.

813,028. Sewer Cleaner. John M. Thompson, Buffalo, N. Y.

817,996. Apparatus for Treating Sewage. M. V. B. Smith, New York, N. Y.

818,164. Cover and Trap for Catch Basins and the Like. Paul Hanagan, Lawrence, Mass.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Washington, Ill.—This city has constructed 30 blocks of new walks this year. A. D. Thompson, of Peoria, was the contractor.

Atlantic City, N. J.—October 17 has been set as the date for the celebration of the "discovery" of Atlantic Avenue, which has recently been paved with bitulithic after 20 years of agitation of the abutting property owners of the paving proposition. The bitulithic pavement extends the whole length of the avenue, four miles, and has an area of 153,056 square yards.

Leavenworth, Ind.—In a recent consultation with City Engineer Maduska, G. W. Speilman of the Barber Asphalt Paving Co., stated that Shawnee street would be resurfaced in the last year of the contract with the city, whch expires in October, 1910. The company, according to its representative, does not contemplate repaving the entire street, but only those sections where a large portion of the asphalt is worn away.

Waynesville, N. C.—The suit of the Southern Paving & Construction Co. against this city has been settled. The company alleged that the city owed it about $16,000 for paving; that the first note, which became due some time ago, had not been paid and that the money from paving assessments collected from the property owners which should have been set aside to pay the notes had been expended for other purposes. The company asked the court to enjoin the municipal authorities from further expenditure until an accounting could be made. The city has agreed to pay the first note due the plaintiff, and the other two when they become due; also, to put aside in the bank a sufficient sum to meet these notes.

Goshen, Ind.—In the Improvement and Contracting News Department of the September number of MUNICIPAL ENGINEERING was a statement concerning the forfeiture of a street paving contract in Goshen, Ind., taken from several of our exchanges, which was incorrect. The contract in question is one which was awarded to the Western Construction Co., of Lafayette and Indianapolis for paving Sixth street with asphalt. This company completed the sewer work required in connection with the street some time ago, has nearly completed the curbing, and the work on the contract is proceeding toward completion. This company has a long and successful experience behind it and has been prominent among the contractors in Indiana and adjoining states for years on account of the magnitude and quality of its work.

CONTEMPLATED WORK.

Putnam, Conn.—Citizens voted to issue $20,000 for road improvements.

Cloquet, Minn.—A cement sidewalk on Chestnut st. is contemplated.

Windsor, Conn.—Voted to expend $20,000 for road improvements.

Champaign, Ill.—Brick paving is contemplated for N. Elm st.

Avon, Conn.—Voted to appropriate $20,000 for road improvements.

Forman, N. D.—Voted to issue $2,500 bonds for cement crossings.

Canaan, Conn.—Voted to appropriate $20,000 for highway improvements.

Portland, Conn.—Voted to appropriate $20,000 for road improvements.

Sweetwater, Tenn.—Voted to issue $10,000 for street improvements.

Aberdeen, Wash.—Council will modify the street improvement plans of this city.

Sedalia, Mo.—Resolutions have been passed for paving 4th, 5th, 6th and 7th sts.

Chehalis, Wash.—About $35,000 will be expended for macadamizing several streets.

North Adams, Mass.—City council decided to issue $8,000 bonds for street improvements.

Deep River, Conn.—Citizens voted $20,000 for macadamizing 2 roads.

Seattle, Wash.—Plans have been approved for paving Yesler Way with asphalt and sandstone.

Marshall, Tex.—Voted to issue $200,000 bonds for constructing pavements and sidewalks.

New Orleans, La.—Asphalt paving has been decided upon for Hurst, Neron, Spruce and Plum sts.

Scranton, Pa.—An ordinance has been passed for grading, curbing and paving Green Ridge st.

Somerville, N. J.—Brick and concrete paving is contemplated for Main st. at a cost of $12,000.

Birmingham, Ia.—Asphalt paving for Washington and Clay sts. is contemplated for next season.

Huntington, W. Va.—Voted to issue $35,000 bonds for street intersections. W. T. McAvoy, cy. treas.

Superior, Wis.—Bids will be asked for brick paving on several streets. E. B. Banks, cy. engr.

Aurora, Ill.—Petitions are being circulated asking for both brick and asphalt paving on Claim st.

Butte, Mont.—Bids will probably be received about Mar. 1 for paving. Alex Leggat, cy. engr.

Jasper, Ala.—Special. Plans for cement walks and other street improvements are being prepared by P. Byrne, of Birmingham, and contracts will be let as soon as they are completed.

Des Moines, Ia.—Resolutions of necessity were passed Sept. 16 for paving W. 16th, W. 6th and W. 7th sts. with creosoted wood blocks.

Lorain, O.—City council has decided to pave 10th ave. from Penfield ave. to Fulton st. with slag.

Trinidad, Colo.—Bids will be asked

for constructing asphalt paving on Main and Commercial sts.

Danville, Ill.—Ordinances have been passed for constructing concrete sidewalks on several streets in Oaktown.

Peoria, Ill.—The question of paving Washington st. in East Peoria will be taken up by the village board soon.

Gibson City, Ill.—The contract will be let soon for paving 5 streets. Geo. W. Wood, supt. sts.; Mayor Knapp.

Petersburg, Ill.—City council has passed an ordinance providing for the construction of concrete sidewalks on the principal streets.

Des Moines, Ia.—City council has passed an ordinance providing for the construction of 1¼ mi. of concrete walks.

Clarksville, Ark.—A resolution has been adopted providing for the construction of concrete sidewalks on the principal streets.

Des Moines, Ia.—Asphalt paving is contemplated for W. 30th st. and creosoted wood block paving for W. 6th, 7th and 16th sts.

Jasper, Ala.—Plans are being prepared for constructing cement walks and other street improvements. L. M. Smith, cy. clk.

Houston, Tex.—About 75-mls. of rock, gravel and shell paving is contemplated. John B. Ashe, co. audt.; Geo. A. Horton, co. engr.

Jefferson City, Mo.—A resolution has been passed to pave McCarty st. with macadam, with cement curb and gutter. Geo. N. Winston, cy. clk.

Escanaba, Mich.—Council has authorized property owners on several streets to replace at once all defective wood sidewalks with cement.

Woonsocket, R. I.—A resolution has been passed providing for an appropriation of $6,000 for paving Court st. bridge with wood block.

Salt Lake City, Utah.—The bd. of pub. wks. has recommended the resurfacing of Main st. with asphalt with cement gutters. Louis C. Kelsey, cy. engr.

Racine, Wis.—The aldermen and residents of the south side are in favor of macadamizing the streets in that section of the city within the next year.

Warsaw, Ind.—Profiles are being prepared and grades will be established for constructing concrete walks on E. Market st. Geo. McCarder, cy. engr.

Selma, Ala.—Ordinances have been passed and bids will be asked soon for paving Broad st. with asphalt and Water st. with vitrified brick. City Atty. Young.

Springfield, O.—A resolution has been passed directing the city engineer to prepare plans an dspecifications for paving So. Fountain ave. with bitulithic, asphalt or brick.

Pine Bluff, Ark.—The property owners on 7 blocks of 3d ave., 2 blocks of Alabama st., and 3 blocks of Georgia st. have petitioned for brick, asphalt, bitulithic, rock, gravel or other paving material.

New Albany, Ind.—Plans and specifications have been adopted for paving E. 10th and E. 11th sts. with vitrified brick. Samuel T. Mann, cy. engr, has been directed to prepare plans and specifications for reconstructing W. Main st. with vitrified brick on concrete base.

St. Louis, Mo.—Special. The residents on Calvary ave., 1½-mi. long, have petitioned the municipal assembly and bd. of pub. impvts. to pave that thoroughfare. Ordinances have been passed for constructing a large number of granitoid sidewalks, and improve a number of alleys.

CONTRACTS TO BE LET.

Fond du Lac, Wis.—Bids are asked until Oct. 12 for paving an alley with brick. B. P. W.

Kenosha, Wis.—Bids are asked until Oct. 7 for paving Grand ave. with brick. Jas. German, cy. clk.

Sunman, Ind.—Bids are asked until Oct. 14 for constructing cement sidewalks. E. R. Behlmer, town clk.

Logansport, Ind.—Bids are asked until Oct. 21 for constructing a free gravel road. Geo. W. Cann, co. audt.

Athens, Ala.—Bids are asked until Oct. 12 for constructing certain highways. C. D. Glaze, prest. rd. comrs.

Salem, Ind.—Bids are asked until Oct. 7 for constructing 30,898-ft. of gravel roads. S. G. Ellis. co. audt.

Decatur, Ind.—Bids are asked until Oct. 7 for constructing a macadam road in Root twp. C. D. Lewton, co. audt.

Hartford City, Ind.—Sealed bids are asked until Oct. 7 for constructing macadam roads. L. W. Daugherty, co. audt.

Rapid City, S. D.—Bids are asked until Oct. 4 for constructing cement walks at the court house. Robt. Rudesill, co. audt.

Cleveland, O.—Sealed bids are asked until Oct. 5 for completing the Miles ave. improvement. Julius C. Dorn, clk. co. comrs.

Martinsville, Ind.—Bids are asked until Oct. 8 for constructing 2 highways in Washington twp. B. E. Thornburgh, co. audt.

Monticello, Ind.—Bids are asked until Oct, 8 for grading, draining and paving with stone sundry roads. J. L. Ackerman, co. audt.

Osgood, Ind.—Sealed bids are asked until Oct. 4 for constructing stone sidewalks on Elm and Osgood sts. Gep. Dopp, town clk.

Spencer, Ind.—Bids are asked until Oct. 2 for constructing 6176-ft. of gravel pike in Jennings twp. Geo. O. Mitten, co. audt.

Chillicothe, O.—Sealed bids are asked until Oct. 4 for constructing cement sidewalks on Locust st. Chas. Hermann, prest. B. P. S.

Vincennes, Ind.—Sealed bids are asked until Oct. 8 for constructing 8000-ft. of gravel roads in Vincennes twp. John T. Scott, co. audt.

Riverton, Ala.—Bids are asked until Oct. 12 for paving, riprap and excavation at Colbert Shoals Canal. Maj. Wm. W. Harts, engr. corps.

Ft. Wayne, Ind.—Bids are asked until Oct. 12 for constructing 6020-ft. of macadamized road in Monroe twp. Geo. W. Lindemuth, co. audt.

Covington, Ind.—Sealed bids are asked until Oct. 8 for constructing 4 separate highways in Troy, Jackson and Cain twps. Wm. B. Gray, co. audt.

Cincinnati, O.—Sealed bids are asked until Oct. 11 for constructing Hog Back road, Observatory ave. extension. Stanley Struble, prest. co. comrs.

Honolulu, H. I.—Sealed bids are asked until Oct. 15 for furnishing 14,000 bbls. of Portland cement, 16,500 tons of broken stone, and 7000 tons of sand. C. W. Otwell, capt. engrs.

Rushville, Ind.—Sealed bids are

asked until Oct. 7 for grading, draining and paving with crushed stone a highway in Noble twp. Chas. H. Kelso, chmn. co. comrs.; A. L. Winship, co. audt.

Jeffersonville, Ind.—Sealed bids are asked until Oct. 7 for constructing gravel roads. John Schellers, chmn. co. comrs.; Geo. B. Parks, co. audt.

Ocala, Fla.—Bids are asked until Oct. 15 for constructing 14,901-sq. yds. of vitrified brick paving. J. D. Robertson, prest. cy. coun.

Harrisburg, Pa.—Bids are asked until Oct. 3 for constructing 5280-ft. of road in Londonderry twp., Dauphin co., and until Oct. 9 and 10 for constructing a large number of roads. Jos. W. Hunter, State highway comr.

Palatka, Fla.—Sealed bids are asked until Oct. 8 for 22,805-sq. ft. of vitrified brick paving on Water and Lemon sts, and 9857-lin. ft. granite curbing and 54 circular granite corner stones. Chmn. bd. bond trustees.

New York City—Sealed bids are asked until Oct. 3 for repairing asphalt pavement on Glenmore ave. and Eastern Parkway extension, and resurfacing walks in Prospect Park, Brooklyn boro. Moses Herrman, prest. Park comrs.

St. Louis, Mo.—Sealed bids are asked until Oct. 8 for constructing vitrified brick paving on 25 streets, bitulithic paving on 2 streets, granite block paving on 2 streets, and granitoid sidewalks on a number of streets. Andrew J. O'Reilly, prest. B. P. I.

Brooklyn, N. Y.—Sealed bids are asked until Oct. 2 for paving a number of streets with vitrified brick, asphalt, wood blocks and granite and limestone blocks. H. S. Dietrich, prest. bd. local impvts.

Crawfordsville, Ind.—Sealed bids are asked until Oct. 8 for grading and paving with crushed stone a certain highway in Brown twp. Benj. F. Carmin, co. audt.

Chicago, Ill.—Sealed bids are asked until Oct. 2 for paving a number of streets with vitrified brick, asphalt, wood blocks and granite and limestone blocks. H. S. Dietrich, prest. bd. local impts.

CONTRACTS AWARDED.

Akron, O.—The contract for paving Sherman st. was awarded, Sept. 12, to J. M. Davidson.

Butte, Mont.—B. M. Bardson & Co. have been awarded the contract for paving Dakota st. at $5.80 sq. yd.

Aurora, Ill.—The contract for paving 2nd ave. with brick was awarded, Sept. 13, to Salfisberg & Co.

New Britain, Ct.—A 3500-sq. yd. contract for bitulithic will be executed by Warren Brothers Company of Boston.

Anniston, Ala.—The contract for paving the sidewalks on Noble st. was awarded to John Bigler, at 92 cts. a sq. yd.

Gastonia, N. C.—The contract for 10,000-sq. yds. of bitulithic paving was awarded to the Atlantic Bitulithic Co., of Richmond.

Frankfort, Ind.—The Western Construction Co., of Lafayette, was awarded the contract for 15,000-sq. yds. of bitulithic paving.

Barberton, O.—Paul & Henry secured the contract for paving High and Cornell sts., Bolivar road, and Hunsberger and Lake aves., for $64,138.02.

New Haven, Ct.—Warren Brothers Company, of Boston, has been awarded a contract for 27,120 sq. yds. of bitulithic.

Dayton, O.—The contract for paving River st. with Twentieth Century block was awarded to Al Wroe & Son, for $22,422.75.

Fort Leavenworth, Kas.—The contract for asphalt paving with vitrified brick gutters was awarded to James Stanton, of Leavenworth.

Jacksonville, Fla.—The contract for paving Adams st. with brick was awarded to the Georgia Engineering Co., of Augusta, at $1.69 a sq. yd.

LaGrange, Ind.—A. L. Bender, of Topeka, was awarded the contract for constructing cement sidewalks at the court house, at 90 cts. a sq. yd.

Dillondale, O.—The contract for paving a number of streets with brick with concrete curbing was awarded to Rosser & Maloney, of Bellaire, for $13,321.35.

Cincinnati, O.—The Kirchner Construction Co. submitted the lowest bid, Sept. 16, for paving 9th st. with wood, at $27,445.50, and Central ave. for $7,433.

Salem, Ore.—The Warren Construction Company of Portland, Ore., will construct 9,277 sq. yds. of bitulithic.

Portland, Me.—An additional contract for 1782 sq. yds. of bitulithic has been awarded the Warren Brothers Company of Boston.

Gastonia, N. C.—The Atlantic Bitulithic Company of Richmond, Va., has been awarded a 10,000 sq. yd. contract for bitulithic.

Newcastle, Ind.—The Western Construction Company of Lafayette, Ind., has received a contract for 15,227 sq. yds. of bitulithic.

Toronto, Ont.—The Warren Bituminous Paving Company of Toronto, has been awarded a contract for 12,147 sq. yds. of bitulithic.

Charlotte, N. C.—A contract for 44,000 sq. yds. of bitulithic has been awarded the Atlantic Bitulithic Company of Richmond, Va.

Zanesville, O.—The contract for paving Center st. with brick was awarded to Petit & Abele at $1.07 a sq. yd. and 30 cts. a lin. ft. for concrete curbing.

Freeport, Ill.—Wm. Ascher was awarded the contract for macadamizing 5th ave., Homer, Chestnut, American and a number of other streets, Sept. 5, for $70,957.50.

Gladstone, Mich.—The contract for constructing several blocks of macadam paving was awarded to the Northern Construction & Engineering Co., of Escanaba, for about $18,000.

Cohoes, N. Y.—The contract for paving Olmsted, Factory and Mohawk sts. with granite blocks was awarded, Sept. 3, to Mulderry Bros., of Albany, at $1.60 a sq. yd.

Lake Charles, La.—The contract for constructing 16-mis. of street paving and 16-mis. of sidewalks was awarded, Sept. 10, to the West Construction Co., of Chattanooga, Tenn.

Galena, Ill.—C. A. Geiger & Son secured the contract for paving Franklin st. at $1.65, Water st. $1.40, lower Franklin st. $1.75, and intersection of Dodge and Spring sts. $1.75.

Milwaukee, Wis.—The Hansen Cement Co. was awarded the contract for boulevarding 22nd ave. at 45 cts. a ft. for curbing and gutters and 12 cts. a sq. ft. for cement sidewalks.

Toledo, O.—Wm. G. Ryan was awarded the contract for paving Madeline st. with brick for $3781.20, and Henry Sheehan secured the contract for paving Niagara st. with Logan block for $6510.50.

El Paso, Tex.—The Southwestern Railroad Co. awarded a contract, Sept. 13, to the Texas Bitulithic Paving Co. for paving 6 streets abutting upon its railroad property, for $11,318.77, with bitulithic.

Portland, Ore.—A contract for 16,997 sq. yds. of bitulithic has been awarded to the Warren Construction Company of Portland, Ore., and another of 25,814 sq. yds. to the Pacific Bridge Company.

Milwaukee, Wis.—The Barber Asphalt Paving Co. was awarded the contract, Sept. 14, for paving 3rd and W. Water sts. with asphalt at $2.23 a sq. yd., resurfacing to be done on the existing concrete foundation.

Mobile, Ala.—Contracts for sidewalk paving were awarded, Aug. 29, as follows: 2nd and 4th ventures, Brandon & Son, of Mobile, $1.28 and $1.18 a sq. yd. respectively; 3rd venture, Koofman & Co., of Mobile, $1.15 a sq. yd.

St. Joseph, Mo.—Ralskliffe & Gibson secured the contract for paving Mitchell ave. at $2.10 a sq. yd., and G. O. Skilbred secured the contract for Delaware st. at $1.96 a sq. yd. Brick will be used in both improvements.

Chicago, Ill.—The Barber Asphalt Paving Co. was awarded the contract, Sept. 10, for paving String st. with asphalt, for $15,716, and the R. F. Conway Co. secured the contract for paving Ruble st. with asphalt, for $15,168.

Birmingham, Ala.—Contracts for constructing 100,000-sq. yds. of paving, 30,000 sq. yds. of cement sidewalks, 80,000-lin. ft. of curb and gutter, and 40,000-cu. yds. of excavation, have been awarded to E. W. Jordan, for $160,625.

Johnson City, Tenn.—The Barber Asphalt Paving Co. was awarded the contract for 48,000-sq. yds. of asphalt paving in the business part of this city, Sept. 12. S. H. Pouder secured the contract for sidewalks, curbs and gutters for $5397.

Spokane, Wash.—The contract for paving Sprague ave. and Arthur st. was awarded, Sept. 6, to the Independent Paving Co., for $56,495; maintenance for 10-yrs., $5,650. The Barber Asphalt Paving Co. secured the contract for paving Monroe st. for $5565; maintenance 10-yrs., $556.

Milwaukee, Wis.—Contracts for grading, macadamizing, guttering, and paving were awarded, Sept. 13, as follows: 39th st., Fred Vogt; Western ave., Arthur Froemming; Cherry st., Hase & Weiher; Walnut st., Hase & Weiher; Murray ave., C. F. Haworth; Bottom st., Frank Brzeinski; Burleigh st., P. F. Murphy.

Salt Lake City, Utah—J. P. O'Neill, of Ogden, was awarded the contract for constructing sidewalks in extension No. 89, which was left uncompleted two years ago by the Utah Fireproofing Co., at 19 cts. a sq. ft., or $35,271.60. P. J. Moran was awarded the contracts for extension No. 84, a part of the uncompleted work of the Utah Fireproofing Co.

Chicago, Ill.—Michigan ave., from 22nd st. to 39th st, 33rd st. from Michigan ave. to South Park ave., and South Park ave. from 33rd to 35th sts., is to be surfaced with bitulithic, the contract having been awarded to the Chicago Bitulithic Company. The contract calls for 72,623 sq. yds. of surfacing for the old macadam foundation.

Indianapolis, Ind.—The contract for resurfacing N. Meridian st., from Vermont to St. Clair, with creosoted wood blocks was awarded, Sept. 11, to the Hoosier Construction Co., at $8.53 a ft. for the lower end and $5.47 a ft. for the upper end of the street. On Sept. 23 the bd. of wks. decided to rescind all action on the contract informally let for the work and the bids were rejected before any written agreements had been entered into. A wrangle in which charges and counter charges were made between the rival companies bidding on the work is said to have influenced the board.

Providence, R. I.—Contracts for constructing various highways have been awarded as follows: Coventry, 31,680 ft., John Bristow, $23,410; Gloucester, 10,560 ft., A. W. Steere $7,814; Glouces- and Burrillville, 5,280 ft., A. W. Steere, $3,819; Foster, 5,280 ft., A. W. Steer, $3,970; Jamestown, 5,280 ft., Alton Steere, $3,819; Foster, 5,280 ft., A. W. Steere, $3,970; Jamestown, 5,280 ft., T. J. Guinn, $2,528; Little Compton, 5,280 ft., Lane Construction Co., $5,408; Narragansett, 7,920 ft., John Bristow, $10,398; Portsmouth, 3,000 ft., Lane Construction Co., $3,577; Tiverton, 2,640 ft., L. H. Callan, $2,192; Warwick, 15,840 ft., Daniel A. Watson, $2 per cu. yd.

Albany, N. Y.—Bids were submitted Sept. 3, 4 and 5 for improving state highways, but only a few contracts have, so far, been awarded, which are as follows: Stewart-Kerbaugh-Shanley Co., 527 Fifth Ave., New York: Syracuse Turnpike road, Madison co., $12,525; Syracuse-Watertown road, Oswego co., $23,475; Fonda-Tribes Hill road, Montgomery co., $18,705; Saratoga-Greenfield-Schuylerville-Glens Falls road; Collins-Morton corner road, Sec. 1; Phoenix-Pennellville road, Oswego co.; Lawton-Gowanda road, Erie co.; East Nassau-Brainard road, Rensselaer co.; Hamburg-Springville road, Sec. 1, Erie co.; Watertown-Theresa road, Sec. 3, Jefferson co.; Mt. Morris-Geneseo road, Livingston co.; Norwich-South New Berlin road, Chenango co.; Alden-Town line and Clinton St.-Marilla road, Erie co.; Trumansburg-Ithaca road, Tompkins co.; Carmel-Kent road, Putnam co.; Cayuga Heights-Henshaw Corners road, Niagara co.; Hamburg-Springville road, Sec. 2, Erie co.; Cortland-Dryden road, Sec. 2, Cortland; Auburn-Owasco road, Cayuga co.; Base Line-Grand Island road, Sec. 1, Erie co.

E. M. & W. Ferguson, Fisher's Island, N. Y., Crescent Avenue road, Suffolk co., $16,896.

Fred W. Knickenburg, 702 Michigan ave., Buffalo, N. Y., Maple Ridge road, Sec. 1, Orleans co., $17,947; Maple Ridge road, Sec. 2, Orleans co., $16,636.

Joseph Walker, Albany, N. Y., Plattekill-Modena road, Ulster co.

H. C. Schroeder, 394 South ave., Rochester, N. Y., Reservation Road-Fayette, Seneca co.

Whitmore, Rauber & Vicinus, Rochester, N. Y., Portland ave. road, Sec. 2, Monroe co.

Morris Kantrowitz, Albany, N. Y., Saratoga-Gansevoort road, Saratoga co.

Jeremiah T. Finch, Glens Falls, N. Y., Latta road, Monroe co.: Syossett-Cold

Spring Harbor road, Nassau co.; West Chazy-Chazy road, Clinton co.

Mosier & Summers, 1266 Seneca st., Buffalo, N. Y., North Collins-Lawton road, Erie co.

Newport Construction Co., Newport, Herkimer co., N. Y., Middleville-Poland road, Herkimer co.; Norwich-Kings Settlement road, Chenango co.

Molloy & Davis, Schenectady, N. Y., Troy-Schenectady road, Sec. 2, Schenectady co.

Casey & Murray, Rochester, N. Y., Utica-Bridgewater road, Oneida co.; Mohawk River Road-Rome, Oneida co.

Lane Construction Co., Syracuse, N. Y., Matteawan-Wicopee road, Dutchess co.

Reardon & Byrnes, Glens Falls, N. Y., Sandy Hill-Glens Falls road, Warren co.

Gantz Wilson Construction Co., Buffalo, N. Y., Olean-Allegany road, Cattaraugus co.

Hinman & Sproul, Schenectady, N. Y., New Lebanon-Brainard road. Columbia co.

SEWERS.

Clinton, Ok.—The Clinton Sewer Co. has been incorporated by Henry Schafer, of El. Reno, A. Long T. J. Nance, W. H. Cokeman, J. C. Davis, R. G. Brewer and Will Coleman, of this city.

CONTEMPLATED WORK.

Bennettsville, S. C.—A sewerage system is contemplated.

Bloomfield, Ia.—A sewerage system is contemplated.

Bessemer, Ala.—Voted to issue bonds for constructing storm sewers.

Stanwick, N. J.—The construction of sewers is contemplated.

Willows, Cal.—The construction of sewers is contemplated.

Houghton, Mich.—The residents on Clark st. have petitioned for a sewer.

Elkins, W. Va.—Plans have been prepared for the extension of the sewerage system.

Milan, Mich.—The construction of a sewerage system is contemplated.

Glendive, Mont.—Council is considering sewer extensions for next year.

Troy, N. Y.—A resolution has been passed for constructing a sewer in Parkview court.

Aylmer, Ont.—The question of constructing a sewerage system is under consideration.

Huntington, W. Va.—Voted to issue $10,000 bonds for sewers. W. T. McAvoy, cy. treas.

Silvis, Ill.—The business of this town are endeavoring to secure a sewerage system.

Eveleth, Minn.—The installation of a storm and sanitary sewerage system is proposed.

St. Joseph, Mo.—An issue of $325,000 bonds for the extension of main sewers is contemplated.

Canon Falls, Minn.—The construction of sewers on 4th and Colville sts. is contemplated.

Lincoln, Neb.—Bids will be asked soon for constructing a sanitary sewer in dist. No. 31.

South Haven, Mich.—A resolution has been adopted to construct a lateral sewer. A. Ryall, cy. clk.

Clear Lake, Ia.—Plans and specifications are being prepared for sanitary sewers and septic tanks.

Zanesville, O.—Plans have been approved for constructing sewers in the southwestern district.

Scranton, Pa.—The construction of a relief sewer in the hill section of this city is contemplated.

Terre Haute, Ind.—An ordinance appropriating $33,050 for constructing sewers in numerous streets is contemplated.

Sea Cliff, L. I., N. Y.—The establishment of a sewage disposal system is favored by the village impvt. assoc.

Two Harbors, Minn.—The property owners on 2nd ave. have petitioned for a 300-ft. lateral sewer on 2nd ave.

Belleville, Ill.—Ordinances were passed Sept. 16 for the extension of sewers on Eace, Hight, Jackson and Church sts.

Wellington, Kas.—Special. This city has engaged H. A. Rowland, of McPherson, to design a system of sanitary sewers.

Santa Monica, Cal.—City council is reported as investigating the plan of the Board of Trade for a sewage disposal system.

East St. Louis, Ill.—The construction of a sewerage system at a cost of about $780,000 is contemplated. Silas Cook, mayor.

Rumford, Me.—The question of constructing a new sewerage system is under consideration and may be voted soon.

Kenmare, N. D.—The question of installing 14 blocks of sewers and a septic tank is being considered by the village trustees.

Hamilton, O.—Sealed bids are asked until Oct. 12 for the purchase of $20,000 storm sewer bonds. Thad Straub, cy. audt.

Rutledge, Pa.—A committee has been appointed to devise ways and means for procuring a sewerage system for this borough.

Ashtabula, O.—Plans have been accepted for constructing a sewer in the west end of this city. L. A. Amsden, cy. engr.

University, Mo.—Plans have been prepared and bids will be received soon for a vitrified pipe sewer system. B. G. Lewis, Mayor.

New Orleans, La.—The bids submitted for constructing sewers were $300,000 above the estimate for the work and were rejected.

Bristol, R. I.—The town council has decided to accept the plans of Capt. Robt. N. Turner for installing a sewer at Bristol Neck.

Middletown, O.—The city engineer has been directed to prepare plans and specifications for constructing a sewer in 1st st. and an alley.

Provo City, Utah.—Specifications for constructing a sewer on 2nd East st. will be prepared by city engr. Pack and Superintendent Armistead.

Madison, N. J.—A resolution was passed Sept. 10 for constructing a sewerage system and disposal plant. Will vote on the question Oct. 14.

Brazil, Ind.—Plans and specifications are being made for constructing a sanitary sewer system through this city, beginning at Hadleytown suburb. Cy. clk.

Newark, N. J.—The finance committee of common council has recommended an appropriation of $10,000, to be made from the city's funds, to the Passaic Valley Sewerage Commission, to enable it to proceed with the prelimi-

naries of building the proposed trunk sewer.

Morenci, Mich.—Estimates for a sewerage and water-works system are being prepared by the Riggs-Sherman Co., of Toledo. The question will be submitted to vote.

Humboldt, Neb.—The question of constructing a sanitary sewer system will be voted on. Plans and specifications will be made by M. N. Blair, of Falls City, Neb.

Louisville, Ky.—Plans and specifications are being prepared and bids will be asked soon for constructing the southern outlet sewer and the Beargrass creek interceptor.

Champaign, Ill.—City engr. Fairclo is preparing a map for the western part of this city preliminary to constructing a sewerage system for that section.

Chattanooga, Tenn.—The bd. of pub. wks. decided, Sept. 17, to ask for bids soon for constructing the Chestnut st. sewer from 9th st. to the river. Robt. Hooke, cy. engr.

Orrville, O.—Plans are being prepared for a sewage disposal plant, requiring a 100,000-gal. concrete septic tank and 12-mis. of 15 to 18-in. vitrified tile sewer. S. W. Jackson, clk. cy. coun.

Kent, O.—Plans are being prepared for a sewage disposal system, requiring a 150,000-gal. concrete septic tank and 15 to 16 mis. of 8 to 18-in. tile sewer. T. A. McMahon, prest. cy. coun.

Atlantic Highlands, N. J.—The State sewerage commission has decided to have the boroughs to remove their sewerage systems, which extend into the ocean or bays, and install sewage disposal plants.

Blytheville, Ark.—The Business Men's Club has appointed A. C. Lange, W. W. Hollipeter and T. J. Mahan a committee to employ competent engineers to investigate the feasibility of installing a sewerage and water system.

Newark, N. J.—The finance committee of common council has recommended an appropriation of $10,000, to be made from the city's funds, to the Passaic Valley Sewerage Commission, to enable it to proceed with the preliminaries of building the proposed trunk sewer.

Springfield, Ill—The State board of health has warned the Illinois Traction Co. that it must cease contaminating the waters of the Sangamon river at Riverton, above this city. The company's large power house is situated at Riverton on the Sangamon river, from which the water supply of Springfield is secured.

Canton, Miss.—Special. The board of aldermen has directed the temporary postponement of the date for opening bids for the construction of a sewerage system, owing to an unavoidable delay in closing the sale of the bonds. The date for receiving bids has not yet been decided upon. Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

CONTRACTS TO BE LET.

Bisbee, Ariz.—Bids are asked until Oct. 5 for constructing a sewerage system. C. W. Hicks, cy. clk.

Rockwell City, Ia.—Bids are asked until Oct. 7 for constructing a sewer. I. E. Dougherty, cy. clk.

Leipsic, O.—Bids are asked until 12 m. Oct. 2 for constructing a sewer on Poplar st. H. G. Moenter, vil. clk.

Ft. Dade, Fla.—Sealed bids are asked until Oct. 3 for repair and extension to sewer outlet at this post. Constr. Q. M.

Linton, Ind.—Bids are asked until Oct. 7, (readvertisement), for constructing a sanitary sewer. Cy. coun.

Braddock, Pa.—Bids are asked until Oct. 3 for constructing sewers in sundry streets. C. A. Stewart, boro engr.

Berwyn, Ill.—Sealed bids are asked until Oct. 3 for constructing a pipe sewer. O. B. Munger, prest. bd. local impvts.

Mingo Junction, O.—Bids are asked until 12 m. Oct. 2 for constructing 4200-ft of sewer. Frank McLister, vil. clk.

Normal City, Ind.—Sealed bids are asked until Oct. 8 for constructing a main outlet sewer. Jas. G. Mendenhall, town clk.

Lorain, O.—Sealed bids are asked until 12 m. Oct. 1 for constructing sewers in a number of streets. Geo. N. Damon, clk. pro tem.

Fort Du Pont, Del.—Bids are asked until Oct. 10 for remodeling sewer and water systems, etc. here. Capt. J. L. Knowlton, Q. M.

Jasper, Ala.—Sealed bids will be received until Oct. 3 for constructing a sewerage system. P. Byrne, cons. engr., Birmingham.

Fort Crook, Neb.—Bids are asked until 10 a. m. Oct. 2 for constructing a 10-in. sewer here. Major Thomas Crook, Q. M., Omaha.

Ann Arbor, Mich.—Bids are asked until 7:30 p. m. Oct. 2 for constructing a sewer on Observatory st. Prest. Cornwell, of B. P. W.

Seattle, Wash.—Bids are asked until Oct. 12 (readvertisement), for constructing the Green Lake section of the north trunk sewer.

Leipsic, O.—Bids are asked until Oct. 2 for constructing a sewer, manholes, etc. in Popular st. Riggs & Sherman, engrs., Toledo.

Muscatine, Ia.—Sealed bids are asked until Oct. 8 for furnishing and placing c. i. pipe at Cross Leaves, section 5. A. S. Lawrence, co. aud.

Columbus, O.—Sealed bids are asked until Oct. 4 for constructing the East Side sewage pumping station and connections. E. F. McGuire, secy. B. P. S.

Ft. Bayard, N. Mex.—Bids are asked until 11 a. m. Oct. 2 for additional work in connection with the sewage purification plant. Capt. S. P. Vestal, Q. M.

Carthage, Mo.—Sealed bids are asked until Oct. 14 for constructing 3258-ft. of 8-in. and 410-ft. of 10-in. sewers, with manholes, flush tanks, etc. Wm. Kohlman, cy. engr.

Paducah, Ky.—Sealed bids are asked until 3 p. m. Oct. 1 for constructing lateral connections to the sewer mains in sewer dist. No. 2. Dr. J. G. Taylor, secy. B. P. W.; L. A. Washington, cy. engr.

Salem, Mass.—Bids are asked until Oct. 2 for constructing sections 1, 2, 3 and 4 of South Salem trunk sewer with brick, or reinforced concrete masonry, requiring about 6913-ft. of 34, 36, 38, 42 and 48-in. sewer. Thos. G. Pinnock, chmn. sewerage comrs.

Aurora, Ind.—Sealed bids are asked until Oct. 11 for constructing a sewerage system, consisting of 400-lin. ft.

20-in. vit. sewer pipe; 50-ft. 20-in. c. i. pipe inc. concrete protection; 816-ft. 18-in. vit. sewer pipe; 878-ft. 15-in. vit. sewer pipe; 50-ft. 15-in. c. i. pipe inc. concrete protection; 1106-ft. 12-in., 450-ft. 10-in. vit. sewer pipe; 50-ft. 10-in. c. i. pipe inc. concrete protection; 5381-ft. 8-in., 1770-ft. 6-in., vit. sewer pipe; 18 manholes 22 catchbasins, inlets and lamp holes. C. H. Gore, cy. engr.; C. C. Brown, cons. engr., Indianapolis.

CONTRACTS AWARDED.

Galena, Ill.—C. A. Geiger & Son secured the contract for constructing a storm sewer in Franklin st. for $890.

Muncie, Ind.—C. H. Russey was awarded the contract for constructing a sewer in Franklin st. at $1.35 a lin. ft.

Zanesville, O.—The contract for constructing a storm sewer in Brighton was awarded to Adams Bros., for $1,142.50.

Leipsic, O.—The contract for constructing a sewer on Hickey st. was awarded to F. R. Stone, of Lima, O., for $5,244.

Oelwein, Ia.—The contract for constructing a sewage disposal plant was awarded to R. C. De La Hunt, of Cedar Rapids.

Alexandria, La.—The contract for about 5-mis. of sewers was awarded to P. H. Porter, of Clinton, Ky., for $10,651.

Johnson City, Tenn.—The contract for constructing sewers was awarded to the Hassam Paving Co., Sept. 12, for $5,852.

Merrill, Mich.—The contract for constructing sewers in Alice and Miland sts. was awarded to Edward Eislee, of Saginaw.

Norfolk, Neb.—The contract for constructing sewer dist. No. 1 was awarded to John Elsinger, Jr., of West Point, for $6,670.85.

Nashville, Tenn.—The lowest bids submitted for constructing the city cemetery sewer was that of Curtis & Lesueur, at $6,696.

Oakland, Cal.—The Standard Construction Co. was awarded the contract for constructing a sewer in Channing st. for $9,659.

Portland, Ind.—The contract for constructing a 36-in. sewer in Pleasant st. was awarded to N. R. Griffith, of this city, for $8,463.

Winnebago, Minn.—The J. W. Turner Construction Co., of Des Moines, secured the contract for constructing sewers for about $15,000.

Centralia, Wash.—The contract for constructing a sewerage system was awarded to the Northwest Bridge Co., of Tacoma, for $22,150.

Fayetteville, Ark.—The contract for constructing a sewerage system was awarded to C. W. Watson & Co., of St. Louis, Mo., for $71,377.

Paragould, Ark.—The contract for constructing a sewerage system was awarded to the W. K. Palmer Co., of Kansas City, for about $40,000.

Des Moines, Ia.—The contract for constructing the Center Drive sewer was awarded to the George M. King Construction Co., at $1.37 a lin. ft.

Arkadelphia, Ark.—The contract for constructing a sewerage system in dist. No. 1 was awarded to Robinson Bros., of Pine Bluff, for $28,362.80.

Evansville, Ind.—The Hallerbach & May Contracting Co. was awarded the contract for constructing a concrete sewer in Kentucky ave. for $168,926.

Barberton, O.—Paul & Henry submitted the lowest bid. Sept. 16, for constructing a sewer in sub. dist. No. 2, for $4,987.28, and will be awarded the contract.

Gladstone, Mich.—The contract for installing a sanitary sewerage system was awarded to the Northern Construction & Engineering Co., of Escanaba, for $11,000.

Louisville, Ky.—The contract for constructing the Happy Hollow sewer was awarded to R. L. Clark & Co., for $26,000. The work of construction began Sept. 2.

Two Harbors, Minn.—The contract for constructing the east and north sewers was awarded to Thomas & Mccoy, of Duluth, for $14,994.50 and $6,470.50 respectively.

Kingston, N. Y.—The contract for constructing a portion of an intercepting sewer was awarded to the Haggerty Contracting Co., 215 125th st., N. Y. City, for $14,568.

Norwalk, O.—Bids for constructing storm and sanitary sewers were submitted Sept. 17, as follows: Municipal Engineering Co., of Akron, O., $27,020.79; H. W. Matthews, Lorain, O., $32,110.75; Cummerford & Quinn, Norwalk, $24,889.76; Penny & Corron, Lorain, concrete, $24,285.39; brick, $30,215.84.

New York City—Bids for constructing a brick sewer in Van Courtlandt Park, Boro of Bronx, were submitted Sept. 5 as follows: Janks-Asserson Constr. Co., $117,030; P. F. Brennan, $108,152; Briggs & McLaughlin, $98,254; Thomas Crimmins Constr. Co., $123,397; Haggers Constr. Co., $128,640; Leahy Contr. & Constr. Co., $104,850; Jos. Moore, $111,856; Wakefield Constr. Co., $101,765.

Bozeman, Mont.—The lowest bid submitted Sept. 5 for constructing pipe sewers was that of E. T. Rich, of this city, and was as follows: 250 ft. 6-in. vitr. sewer pipe, 78 cts.; 4,105 ft. 8-in. $1.02; 4,835 ft. 10-in., $1.05; 2,605 ft. 12-in., $1.14; 6,100 ft. 15-in., $1.22; 35 manholes, $78; 1 combined manhole and flush tank, $160; and concrete, $8 per cu. yd.; total, $19,861.

Canal Dover, O.—The contract for constructing a sewerage system was awarded, Aug. 31, to Adam Schwab, of New Philadelphia, O., as follows: 17,669 ft. 8-in. pipe, 57 cts.; 6,432 ft. 10-in., 70 cts.; 467 ft. 12-in., 90 cts.; lumber left in trench, $28 per M, etc.; total, $16,723. Average depth of sewers is 9 ft. 6 in., earthwork, gravel and sand, all castings for flush tanks and manholes furnished by the city.

Seattle, Wash.—The contractor for constructing sewers in 27th ave. S. and other streets was awarded, Aug. 31, to F. McLellan & Co., Burke Bldg., as follows: 307 lin. ft. 18-in. sewer pipe, $3; 347 lin. ft. 15-in. sewer pipe, $2.50; 20 4½-ft. manholes, $80; 200 lin. ft. tile drain, $1; 2 catch-basins, 1 inlet, $90; 727 lin. ft. 42x63-in. sewer pipe, $11; 1,764 lin. ft. 36x54-in., $9.50; 1,203 lin. ft. 30x45-in., $8.40; 529 lin. ft. 24x36-in., $7.30; 4,222 lin. ft. sub-drain, 80 cts.; 3 sand boxes, $100; total, $47,668.

Baden, Pa.—The contract for constructing a system of sanitary sewers was awarded to Thomas Sweeney & Co., 4906 Cypress st., Pittsburg, for $10,545. Other bids submitted were:

George B. Clifford, Martins Ferry, Ohio, $15,312; L. D. McCafferty, Pittsburg, $14,602; Pennsylvania Construction Co., 209 Ninth St., Pittsburg, $16,337; G. Walen & Co., Pittsburg, $13,908; Trefall & De Girno, Pittsburg, $11,141; Ott Bros., 414 Washington Ave., Pittsburg, $15,037; Neelen & Daly, Allegheny, Pa., $14,555, and George S. McFall, Beaver Falls, Pa., $14,985.

WATER WORKS.

Boyertown, Pa.—This town has petitioned for the appointment of viewers to estimate the damages, if any, for the diversion of the waters. The petition states that on Aug. 23 a resolution wa spassed alleging that the present supply of water is insufficient for certain periods of the year, and asked that the solicitor be authorized to institute legal proceedings for condemning, appropriating and taking out of the Papachickon and Ironstone creeks, which flofiw through Earl, Colebrookdale and Douglas, and which empty into the Manatawny creek. The court appointed Daniel K. Flannery, Harry Yohn, Wm. Brunner, Isaac Ney, and Wm. Reeser as viewers to estimate the damages, quality, quantity and value of the water taken out of these streams.

CONTEMPLATED WORK.

Granite, Ok.—A water-works system is proposed.

Bennettsville, S. C.—A water-works system is proposed.

Murray, Ky.—A water-works and electric light system is contemplated.

Silvis, Ill.—A water-works system is contemplated.

Kingwood, Va.—A water-works system is contemplated.

Wolcotville, Ind.—A water-works system is contemplated.

Halstead, Kas.—A water-works system will be installed soon.

Bay City, Tex.—The construction of a water-works system is contemplated.

Union, W. Va.—A water-works system is contemplated. A. S. Johnston, mayor.

Patterson, La.—The construction of a water-works system is contemplated.

Lindsay, I. T.—Voted to issue bonds for installing a water-works system.

Milan, Mich.—Voted to issue bonds for installing a water-works system.

Winnipeg, Man.—The purchase of about 15-mls. of water pipe is contemplated.

Seneca, Ga.—This town is in favor of securing a water-works system.

Montrose, Colo.—Council has purchased a site on which to construct a reservoir.

Linden, Wis.—Plans are being made for a water-works system. H. F. Treloor, vil. clk.

Fairland, Tex.—Plans are being discussed for securing a complete water-works system.

Verona, N. J.—Will vote Nov. 14 on the question of constructing a water-works system.

Sweetwater, Tenn.—Voted to issue $30,000 bonds for constructing a water-works system.

DeQueen, Ark.—Plans and specifications for a water-works system have been filed.

Punta Gorda, Fla.—A resolution has been recommended for sinking an 8-in. artesian well.

Hildreth, Neb.—Voted to issue $10,000 for the purpose of constructing a water-works system.

Tupper Lake, N. Y.—The construction of a standpipe is contemplated by the Tupper Water Co.

North Yakima, Wash.—Will vote Dec. 3 on the question of municipal ownership of the water-works system.

Temple, Tex.—Will vote Oct. 2 on the question of municipal ownership of the water-works system.

Swanton, O.—Council has passed an ordinance to purchase a site for the proposed new water-works.

Millen, Ga.—Voted to issue $30,000 bonds for installing water-works and electric light plant.

Warsaw, Ind.—The construction of a water filter is contemplated by city council. C. A. Rigdon, mayor.

Dickson, Tenn.—Voted to issue $25,000 to provide this town with water-works system. W. T. Turner, mayor.

Aberdeen, S. D.—Special. Miles E. Bell desires to purchase pipe threading machine up to 8-ins., pipe and fittings.

Wausau, Wis.—A bond issue of $30,000 to replace the water mains in the business district is proposed.

Dunkirk, N. Y.—The water bd. has decided to enlarge the water and electric light plants. L. N. Murray, cy. clk.

Columbia, Miss.—The question of issuing bonds for constructing water-works and sewerage system is under consideration.

Capitol Hill, Ok.—The issue of $85,000 bonds for constructing water-works and electric light systems has been authorized.

Brownsville, Tex.—The attorney general has approved the issue of bonds for constructing a water-works and electric light plant there.

Bronte, Tex.—The question of a water-works system is being agitated and local capitalists completed organizing a stock company to install a plant.

Wichita, Kas.—Council is reported as having under consideration the purchase or building of a water plant and is considering offers from engineers.

Madisonville, O.—A resolution has been passed providing for the issue of bonds for extending and enlarging the water-works system. Wm. B. C. Means, mayor.

Wallingford, Conn.—The water comrs. estimate the cost of increasing the water by gravity supply at Pistapang Lake at about $38,000. J. H. Child, engr. & supt. water-works.

Racine, Wis.—A resolution has been approved providing for the purchase of the present water-works plant and the question will be submitted to vote. Mayor Horlick.

Chicago, Ill.—Henry C. Wilson, of the Oak Park village board advocates the establishment of a pumping station at Austin ave. and Lake st. to supply that village.

Newport, Ky.—The superintendent of water-works has been directed to secure estimates of the cost of erecting a water tower near the reservoir in Highlands.

Aurora, Mo.—The mayor has given notice to the water company that the city has under consideration the pur-

chase of the water-works property at the end of this year.

Franklin, Neb.—Special. B. J. Hilsabeck advises us that this place voted recently to issue $17,000 bonds for installing a water-works system. Address inquiries to J. A. Dickie, cy. clk.

Garden City, Kas.—Will vote on the issue of $20,000 bonds for water-works extensions, including the replacing of the present boilers and possibly the installation of new pumps at the pumping station.

Daytona, Fla.—Aldermen Hankins, Bingham and Rowe compose a committee appointed by council to confer with Supt. Gunn of the electric light company with regard to constructing a water-works system for this city.

Blytheville, Ark. — The Business Men's Club has appointed A. C. Lange, W. W. Holipeter and T. J. Mahan a committee to employ competent engineers to investigate the feasibility of installing a water and sewerage system.

Waukesha, Wis.—An exhaustive report presented by President Ernest Merton, of the water commission, on the requirements for the improvement of the water-works system, recommends the replacing of 11,973-ft. of New England water mains in the business district and territory adjacent with standard c. i. mains, at a cost of $20,677.80.

CONTRACTS TO BE LET.

Primghar, Ia.—Bids are asked until Oct. 10 for constructing water-works. W. H. Downing, cy. clk.

Fort Caswell, N. C.—Bids are asked until Oct. 9 for building a pump house, ice plant and cold storage plant. L. Cravens, Q. M.

Muscatine, Ia.—Bids are asked until Oct. 8 for constructing ditches in drainage dist. No. 3. A. S. Lawrence, co. audt.

Fargo, N. D.—Bids are asked until Oct. 9 for constructing a pneumatic water plant at the county hospital. Arthur Lewis, co. audt.

Lockport, Ill.—Sealed bids are asked until Oct. 7 for laying about 1700-ft. of 4-in. water mains with 4 hydrants. Daniel F. Fisher, cy. clk.

Kewanee, Ill.—Bids are asked until Oct. 5 for certain machinery and equipment for pumping water from 2 deep wells. J. C. Bannister. chm. water com.

Fort Du Pont, Del.—Bids are asked until Oct. 10 for remodeling the sewer and water systems and constructing a tank. Capt. J. L. Knowlton, constr. Q. M.

Atlanta, Ga.—Bids are asked until Oct. 23 for constructing a horizontal sectional washing pressure filter plant of 4,000,000-gals. Park Woodward, genl. mgr. water comrs.

Ashland, O.—Bids are asked until Oct. 14 for furnishing and delivering about 350 tons of c. i. water pipe, digging trench and laying 8,500-ft. of water pipe, erecting building at pumping station, building foundations for new machinery and furnishing 14,000-lbs. of pig lead. Bd. pub. affairs.

CONTRACTS AWARDED.

New Orleans, La.—The contract for hauling and laying 20-mis. of water pipe was awarded, Sept. 16, to Irwin Bros., for $225,789.

Sibley, Ia.—The contract for erecting a solid steel tank was awarded to Drake, Williams, Mount & Co., of Omaha, Neb., for $2,600.

Florida, Ala.—The contract for constructing a water-works system was awarded to J. M. McCrary & Co., of Atlanta, Ga., for $16,958.

Salt Lake City, Utah—Contracts for water mains extensions were awarded, Sept. 15, as follows: J. W. Percival, $7,284.10; P. J. Moran, $1,180.20.

Gloucester City, N. J.—The contract for installing a water-works pump was awarded to the D'Olier Engineering Co., 121 S. 11th st., Phila., for $3,495.

New York City—The contract for constructing the Ashokan reservoir in the Catskills was awarded to McArthur Brothers & Co. and Winston & Co., for $12,669.775.

Sandusky, O.—The contract for constructing a municipal filtration plant was awarded to Thomas Lightbody, of Youngstown, and W. M. Henderson, of Warren, for $100,000.

Philadelphia, Pa.—The Millard Construction Co. submitted the lowest bid, Sept. 17, for completing the 3rd st. pipe line from Girard ave. to Market st., for about $100,000.

Pittsfield, Mass.—The contract for constructing a reservoir dam at Ashley Brook to create an additional water supply was awarded to the Ambursen Hydraulic Construction Co., 176 Federal st., Boston.

Louisville, Ky.—The Louisville Water Co. awarded contracts, Sept. 9, for pumping machinery, as follows: engine for driving pumping station, Allis-Chalmers Co., of Milwaukee, $187,952; Crescent Hill pumping station, Holly Mfg. Co., of Buffalo, N. Y., $153,574.

Chicago, Ill.—The contract for erecting the Lake View pumping station was awarded, Sept. 16, to B. M. Zadick & Co., for $88,929. The other bids submitted were: Wm. E. McCarthy, $104,000; Standard Constr. Co., $94,500; American Engineering Co., $111,900; John Peterson, $92,058; Warner Construction Co., $97,900; M. H. McGovern, $105,300.

BRIDGES.

Fargo, N. D.—Bids are asked until Oct. 8 for constructing 5 bridges. Arthur G. Lewis, co. audt.

Eureka, Kas.—Bids are asked until Oct. 10 for constructing a steel bridge. W. H. Bonnett, co. clk.

Vicksburg, Miss.—Bids are asked until Oct. 7 for constructing 4 concrete bridges. H. J. Trowbridge, cy. clk.

Palatka, Fla.—Bids are asked until Oct. 9 for erecting a bridge over St. John's river. R. R. Price, co. engr.

Erie, Kas.—Bids are asked until Oct. 15 for constructing 3 steel or iron bridges. O. M. Johnson, co. audt.

Evansville, Ind.—Sealed bids are asked until Oct. 3 for constructing 3 reinforced concrete bridges. Harry Stinson, co. audt.

Warren, O.—Bids are asked until Oct. 7 for reconstructing the floor of a bridge over Mahoning river, Main st., Niles. Co. audt.

Bellefontaine, O.—Bids are asked until Oct. 14 for constructing a bridge on concrete abutments. Chas. M. Richey, co. surv.

Fergus Falls, Minn.—Bids are asked until Oct. 3 for constructing a steel or concrete bridge over Red river. G. H. Gard, cy. clk.

Los Angeles, Cal.—Bids are asked until Oct. 14 for constructing a reinforced concrete bridge at 7th st. H. B. Ferris, secy. B. P. W.

Salem, Ind.—Bids are asked until Oct. 7 for constructing a steel bridge and stone abutments near Old Pekin. S. G. Ellis, co. audt.

Akron, O.—County engr. Gehres has been directed to prepare plans and estimates for a new bridge over Tuscarawas river, 1-mi. north of Clinton.

Indianapolis, Ind.—Sealed bids are asked until Oct. 5 for constructing a number of bridges and culverts. John E. M'Gaughey, chm. co. comrs.

St. Cloud, Minn.—The Northwestern Bridge & Construction Co. has been incorporated by L. L., C. S., and Wm. L. Sartell, and Joseph Hamilton.

Cleveland, O.—Sealed bids are asked until Oct. 12 for constructing a culvert on Pitney road in East Cleveland. Julius C. Dorn, clk. comrs.

Xenia, O.—Sealed bids are asked until Oct. 12 for constructing a low truss bridge across Sugar creek in Sugar Creek twp. Wm. Dodds, co. audt.

Wichita, Kas.—The city engineer has submitted plans and specifications for constructing a bridge over Wichita drainage canal at Douglas ave.

Williamsport, Ind.—Bids are asked until Oct. 3 for constructing an approach to bridge 37 across Wabash river. R. W. Alexander, chm. co. comrs.

Delphi, Ind.—Bids are asked until Oct. 8 for constructing a bridge or arch culvert across Rock Creek on Michigan road. Fred H. Engle, co. audt.

Frankfort, Ind.—Council has taken steps towards constructing cement arch bridges at Clinton and Walnut sts. and bids will be asked for soon.

Fredericton, N. B.—Bids are asked until Oct. 14 for constructing metal superstructure of Cocagne bridge. C. H. La Billois, comr. dept. pub. wks.

Hammond, Ind.—Bids are asked until Oct. 14 for constructing a swing bridge over Calumet river at Columbia ave. Chas. A. Johnson, co. audt., Crown Point.

Vevay, Ind.—Bids are asked until Oct. 7 for constructing a concrete or iron bridge over Plum creek to replace the present bridge. L. J. Woollen, co. audt.

Crawfordsville, Ind.—Sealed bids are asked until Oct. 5 for constructing a concrete arch in Madison twp. and one in Ripley twp. B. F. Carman, co. audt.

Fremont, O.—Bids are asked until Oct. 7 for constructing a steel and concrete bridge over Big Mud creek, and for other bridge work. S. M. Franizer, co. audt.

Canton, China—Bids are asked until Oct. 19 for constructing a steel cantilever and girder bridge in Front Reach, 740-ft. west of Dutch-folly Fort. Canton River Bridge Co. Ltd.

Vicksburg, Miss.—Bids are asked until Oct. 8 for building a steel bridge over Simrall's Canal, and until Oct. 9 for repairs to Durden bridge. J. D. Laughlin, Chancery clk.

Toledo, O.—Sealed bids are asked until Oct. 14 for constructing 2 concrete masonry abutments for a bridge over Ten Mile Creek, on Ottawa Terrace, Wash. twp. J. W. Kerr, chm. co. comrs.

Harrisburg, Pa.—Sealed bids are asked until Oct. 8 for building a superstructure and substructure of a bridge over Nescopeck Creek in Sugarloaf twp., Luzerne co. Samuel B. Rambo, supt. public grounds.

Winnipeg, Man.—Sealed bids are asked until Oct. 15 for constructing a steel highway bridge on concrete and boulder masonry foundation across Souris river. J. H. Putnam, secy.-treas. municipality Riverside.

Johnstown, Pa.—Council is considering the question of constructing a new 225-ft. steel highway bridge between Haynes st. in the 5th ward and the New Senate Hotel property on Bedford st., spanning Stony creek.

Milwaukee, Wis.—The question of constructing bascule bridges at Buffalo, Michigan and Oneida sts. will be voted on. Park. Comr. Clas has prepared plans for a concrete viaduct to be erected over the right-of-way of the Milwaukee road at Highland Boulevard.

STREET LIGHTING.

Womelsdorf, Pa.—Voted in favor of electric lights.

Hagerstown, Ind.—Voted to establish electric lights.

Prairie City, Ia.—Voted to install a lighting system.

Rawson, O.—The question of municipal street lighting is being agitated.

Union, S. C.—The improvement of the electric light service is contemplated.

Amarillo, Tex.—Will vote on the issue of bonds for a municipal light and water plant.

Punta Gorda, Fla.—Voted to issue bonds for constructing an electric light plant.

Berrien Springs, Mich.—Voted to issue $17,000 bonds for establishing an electrict light plant.

Seneca, Ga.—This town is considering the question of establishing an electric light plant.

Magnolia, Ark.—The question of municipal ownership of the electric light plant is being agitated.

Clay City, Ind.—A franchise and contract for street lighting has been awarded to B. M. Guirl, of this city.

Marysville, Mo.—The citizens voted to grant a 20-yr. franchise to the Maryville Electric Light & Power Co. for street lighting.

Garnett, Kas.—A 20-yr. contract to construct and maintain an electric light plant has been awarded to Joseph Carey, of this city.

Charleston, S. C.—Bids are asked until Nov. 15 for lighting streets and public buildings for 1, 2 or 4 yrs. Ion Simons, cy. electrician.

Ferris, Tex.—The Ferris Light & Power Co. has been incorporated by W. W. Batcheler, C. A. Weatherford, J. S. Wilson, C. N. Brooks, and John V. Jones.

Crawfordsville, Ind.—Sealed bids are asked until Oct. 5 for constructing an acetylene light plant at the county asylum. Benj. F. Carman, co. audt.

Memphis, Tenn.—The lighting com. of the lower board is considering the question of installing a municipal lighting system. J. S. Dunscomb, Chmn.

Jacksonville, Fla.—Bids are asked until Oct. 4 for furnishing and setting up a 1500 k. w. steam turbo-generator, 50 k. w. motor driven exciter. R. N. Ellis, supt. lgt. plant.

Seymour, Ind.—Propositions for about 60 days for furnishing this city artificial gas for light and fuel and for street lighting, etc. Fred Everback, cy. clk.

Hammonton, Pa.—A 5-yr. contract has been awarded the Hammonton Electric Light Co. and the Hammonton & Egg Harbor City Gas Co. to light the streets of this city.

Calcutta, India—Bids are asked until Dec. 31 for lighting this town by electricity, gas, oil or other method. It is now lighted by 9,300 gas lamps of 24-c. p. and 2,400 c. p. oil lamps. Municipal council.

Limerich, N. Y.—The Limerich Water & Electric Co. has been incorporated to furnish water, gas and electricity, by J. F. Moore, prest., of Newfield; C. G. Moulton, treas., of Limerich, and J. W. Lord, clerk, of Limerich.

Norwich, Conn.—The contract for installing a high-tension transmission, 22,000 volts, from Scotland Station on the Shetucket river to the present municipal plant in this city was awarded to the New England Engineering Co., Union St., New London, for $25,000.

St. Louis, Mo.—Special. An ordinance is being drafted by the board of public improvements to be introduced in the municipal assembly soon authorizing the board to let the contract for lighting the public parks and thoroughfares. The present contract does not expire till September, 1908, but it is planned to let the contract now that a competing bidder from outside of the city would have time to erect a plant before the present contract expires. In that way the board expects to save a sum great enough to enable the lighting department to install about 4,000 more lamps without increasing the lighting bill. A large number of new lamps have been installed in the downtown districts, particularly on the most important streets, but the annual lighting bill, already $600,000, is rapidly mounting higher. The business district is being lighted with electricity, arc lamps costing the city $98 a year each, while gas-mantle lamps are being used in the residence districts where a softer light is desired. The latter cost $28 a year. Both are considered much too high.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Oak Park, Ill.—A contract has been awarded Lewis & Kitchen for constructing a garbage crematory.

Oakland, Cal.—The garbage com. of the bd. of health has recommended to city council the purchase of an incinerator.

Cincinnati, O.—The contract for erecting the 2nd st. dumping station was awarded to L. P. Hazen & Co., for $40,500.

Memphis, Tenn.—This city is reported as having under consideration a proposition from the U. S. Constr. & Utilization Co., of Rochester, N. Y., for the construction of a crematory.

Orange, N. J.—The bds. of health of this city and West Orange are considering plans for establishing a garbage crematory, but it has not yet been decided whether a municipal or a private plant will be built.

St. Louis, Mo.—Special. Street Commissioner James C. Travilla has gone to the Jamestown exposition, and before returning he will inspect the systems of collecting garbage and ashes at Cincinnati and other cities.

The board of public improvements, through its president, Andrew J. O'Reilly, has drafted and sent an ordinance to the municipal assembly giving the board authority to let a new contract for the disposal of dead animals found in the streets in such a way that the city will derive a profit. Under the present contract the city is paying about $3000 a year for the disposal of that kind of garbage but a contractor recently remarked that the contract for disposing of the animals was worth $1,000 a month to him, and Mr. O'Reilly at once began drafting the ordinance changing the pay roll. Instead of stating that the contract will be let to the highest bidder the ordinance states that it is to be let to the contractor willing to pay the city the largest sum for the privilege, making the disposal of dead animals a source of revenue instead of expense. Although the board intended to continue the work of collecting the animals at the city's expense it expects to get enough from the contractors to overbalance that cost and give the city a neat sum besides.

PARKS.

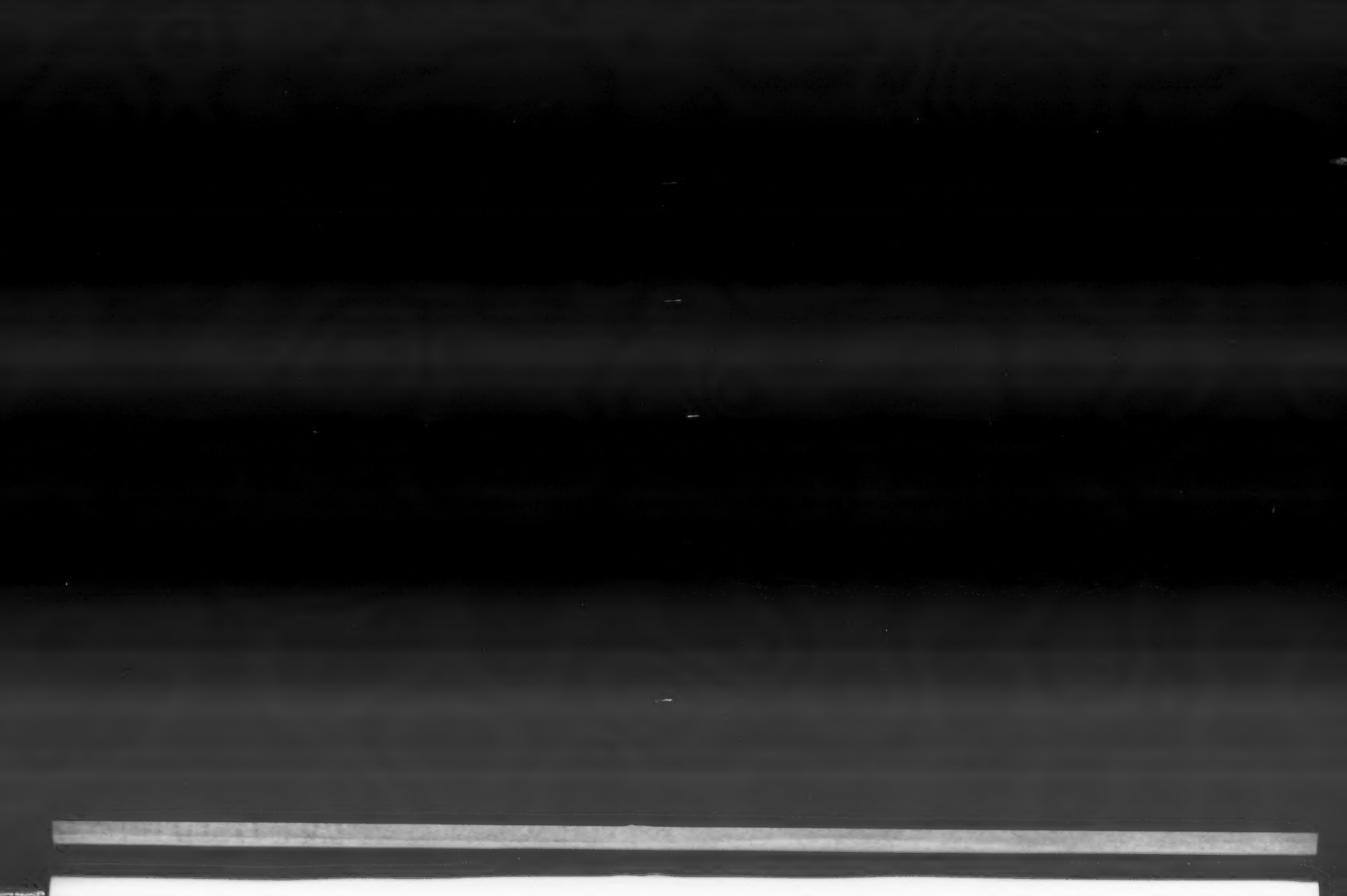
St. Louis, Mo.—Special. Philip C. Scanlan, park comr., has proposed a chain of 15 small lakes for Carondelet park, to be made of a series of sink holes caused many years ago by the sinking of the ground. He suggests that the 15 holes be connected by a chain of small canals or water mains and arranged into a pretty chain of park lakes fed by water from the city mains in case they go dry. He estimates the cost, including a few rustic bridges, at about $5000. Ordinances have been passed by the municipal assembly locating and authorizing condemnation proceedings for the purchase of ground for 5 new public parks in the downtown districts.

FIRE APPARATUS.

Kasota, Minn.—The purchase of a hook and ladder truck is contemplated.

St. Joseph, Mo.—A bond issue of $75,000 for the improvement of the fire department is proposed.

Fond du Lac, Wis.—Bids are asked until 5 p. m. Oct. 2 for 1500-ft. of fire hose. J. F. Hohensee, cy. clk.

Huntington, W. Va.—Voted to issue $8000 bonds for improvements to fire department buildings. W. T. McAboy, cy. treas.

Jeffersonville, Ind.—Sealed bids are asked until 10 a. m. Oct. 1 for 5000-ft. of ¾-in. rubber hose. J. M. Marshall, asst. Q. M.